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INSTRUCTION REPORT NO. 10

ENVIRONMENTAL DATA COLLECTION METHODS.

VOLUME IV: VEGETATION.

Instruction Manual I, Vegetation Structure

May 1968

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Sponsored by

U. S. Army Materiel Command

Conducted by

U. S. Army Engineer Waterways Experiment Station
CORPS OF ENGINEERS
Vicksburg, Mississippi

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INDEX OF VOLUMES

Volume	Factor Family	Title
I	Surface Composition	Instruction Manual 1, Soil Strength and Moisture
II	Hydrologic Geometry	Instruction Manual 1, Hydrologic Geometry
III	Surface Geometry	Instruction Manual 1, Surface Macro-geometry Instruction Manual 2, Surface Micro-geometry
IV	Vegetation	Instruction Manual 1, Vegetation Structure Instruction Manual 2, Vegetation Screening
V	Weather	Instruction Manual 1, Weather

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FOREWORD

The title Environmental Data Collection Methods will comprise a series of volumes, each devoted to a specific factor family of the total environment. The series initially will contain five volumes, each of which will consist of one or more "Instruction Manuals." Each Instruction Manual will have three parts: Part I, outlining the rationale and and objectives of the environmental data collection methods developed by the U. S. Army Engineer Waterways Experiment Station (WES); Part II, consisting of definitions and matters of special concern; and Part III, comprising detailed instructions for collecting specified environmental data in a format compatible with automatic data processing (ADP) techniques. This series of manuals supersedes the previously initiated Instruction Report 6, "Environmental Data Collection Manual," of which only Volume V was issued.

These manuals will be prepared primarily to meet the needs of the Military Evaluation of Geographic Areas (MEGA) project, a major research effort conducted by WES under the auspicies of the U. S. Army Materiel Command. Although intended primarily as instructions for MEGA field teams, the manuals will also provide general guidance for the collection of militarily significant environmental data for other Department of Defense-sponsored projects. They should also prove useful for a variety of non-military applications in which quantitative terrain data are required.

The manuals will be published in loose-leaf form to permit periodic revision as dictated by increased or refined data requirements. Suggestions for revisions, corrections, and additions will be welcomed from users, and changes will be distributed as necessary. Correspondence concerning such matters should be addressed to the Director, U. S. Army

Engineer Waterways Experiment Station, CE, Vicksburg, Mississippi 39180.

This manual was prepared under the direct supervision of Mr. Bob O. Benn, Chief, Data Development Section, and the general supervision of Mr. Warren E. Grabau, Chief, Terrain Analysis Branch (TAB); Messrs. W. G. Shockley and S. J. Knight, Chief and Assistant Chief, respectively, of the Mobility and Environmental Division; and Mr. W. J. Turnbull, Technical Assistant for Soils and Environmental Engineering. The instruction modules for the manual were prepared and compiled jointly by Messrs. Warren E. Grabau, Bob O. Benn, Eugene E. Addor, William N. Rushing, and A. Paul Desmarais, of TAB. The methods were field-checked by the WES Tropical Terrain Research Detachment (TTRD), Puerto Rico, Mr. Jerald Broughton, Chief, and by the field team from Marshall University under the direction of Dr. Howard L. Mills.

During the time of development of the methods and the preparation of these manuals, Directors of WES were COL Alex G. Sutton, Jr., CE, and COL John R. Oswalt, Jr., CE. Technical Director was Mr. J. B. Tiffany.

CONTENTS

ENVIRONMENTAL DATA COLLECTION METHODS

VOLUME IV: VEGETATION

Instruction Manual 1, Vegetation Structure

PART I: INTRODUCTION

Background

1. The function of military terrain analysis is to supply an interpretation of terrain in terms of performance values (or classes) of the military machine or activity under consideration. Thus, a capability for military terrain analysis presupposes a capability for describing the terrain in the terms required as input to a performance prediction analysis. Such an analysis can best be carried out by means of a mathematical model of each activity in specific environmental situations. Because each activity is affected by several independent environmental factors acting simultaneously, models of these interactions involve the establishment of mathematical relations between the environmental factors and their effect on the activity. Further, because the mathematical models will accept only numerical information as input, the environmental data must be stated in quantitative terms.

2. Instructions for collecting quantitative environmental data will be given in five volumes collectively entitled Environmental Data Collection Methods (see INDEX OF VOLUMES inside front cover). The total environment at a given time and place is considered to consist of an aggregate of environmental factors. The number of environmental factors is great, and it is generally convenient to group them into factor familes. Five factor families have been established to cover the principal characteristics of the total environment. These are: surface composition; hydrologic geometry; surface geometry; vegetation; and weather. This manual, Volume IV, Instruction Manual 1, Vegetation Structure deals primarily with the geometry of the physical attributes of plant assemblages.

Purpose

3. This manual is designed primarily to provide specifications for the measurement and recording of quantitative data describing the structural characteristics of vegetation assemblages, but provisions have also been made for the acquisition of qualitative supplemental information, such as plant nomenclature, leaf condition, presence of irritants, and so on. The formats used for recording the data have been designed for compatibility with automatic data processing (ADP) machines to minimize the difficulties of data storage, retrieval, and manipulation.

Scope

4. The quantitative data specified for acquisition are those that have been demonstrated to affect one or more military activities. Such data include those quantitative descriptors that define the three-dimensional geometry of the assemblages, some of which are stem size, stem spacing, height of branching, branching angle, size of leaves, height of plants, and so on. Much of the qualitative supplemental information that is also specified for collection has no direct impact on military activities or machines. This information consists of plant nomenclature, leaf condition, and comments concerning site characteristics of physiognomic or taxonomic anomalies noted among the plants in an assemblage, and so on. Such information is commonly useful for general geographic or regional analyses of vegetation characteristics and for providing insight into vegetation properties for various scientific purposes, and so on.

5. The essential parts of this manual consist of six "Instruction Modules," each of which describes in detail the procedure that must be used to acquire and record specific kinds of data or information. These modules are presented after Part III of this manual.

Site Considerations

6. A normal and extremely important aspect of any data collection

program is the selection of the sites that are to be described and studied. Unfortunately, no specific guidance in this matter can be provided by this manual, because the uses for vegetation structural data are so many and varied. The selection of sites for any given program must be based on the requirements of the individual program since it is unlikely that the same selection criteria will be applicable if project objectives are different.

7. For example, many military terrain evaluation projects require data on the structural characteristics of the vegetation only for a zone from the ground surface to a height of about 3 m. In such cases, the sites should be selected on the basis of apparent structural differences in that zone. Other military activities may be sensitive to crown shapes and branching characteristics within a forest canopy. For such purposes, sites must be chosen to characterize variations within the factor complexes describing those conditions. Still other studies might be concerned with the effects of soil type and topographic position of vegetation structures. For such investigations, sites should be selected to encompass all of the apparent structural variations that can be noted within each soil type and topographic position. Many other kinds of investigations can be imagined, and in general each will be characterized by highly specific site selection criteria.

8. Sites should not be selected without due regard for existing relevant information on the study area. Such information may be in the form of air photographs, forest-type maps, "natural vegetation" maps, land use maps, climatic records, soil descriptions, traveler's reports, and so on. Any or all of these may be extremely useful in planning and conducting a data acquisition program. It must be emphasized that the data that are to be collected in accordance with the procedures in this manual are not to be regarded as independent of prior information, or as supplanting existing data.

9. Finally, the benefits of ground reconnaissance prior to and during the site selection process should not be overlooked. Experience has demonstrated that no amount of study of existing information, maps, and even air photographs, will reveal all of the structural variations in the vegetation of a region. Only careful and thoughtful examination on the ground will suffice.

PART II: DEFINITIONS AND SPECIAL CONSIDERATIONS

Terms Related to Plants and Plant Assemblages

10. The Instruction Modules that describe the procedures for acquiring quantitative structural data for vegetation assemblages use a number of terms in very restricted senses. It is essential that users of this manual understand the usage of these terms. Definitions are as follows:

Component. An individual plant, or any aggregation of plants so closely associated that they cannot logically be separated. An example of such an association is a tussock of marsh grass.

Determinant. The factor value, factor value class, or association of factor values or factor value classes selected to characterize the population that determines the size of the structural cell. See paragraphs 12 and 13 for a detailed discussion of the relation between the determinant and the structural cell.

Factor. Any attribute of a plant or plant association that can be described by a single numerical descriptor. Example: "plant height" and "stem diameter" are both factors.

Factor value. The numerical descriptor obtained by measuring a factor on a specific plant or plant association. For example: "27 cm" is the factor value obtained by measurement of a plant stem of that diameter.

Factor value class. A specified range of factor values. For example: "18-30 cm" is a factor value class containing all stem diameter measurements from 18 to 30 cm.

Structural cell. Assuming an equally distributed population, the structural cell is the minimum circular area that includes as many determinants as are needed to adequately define the spatial distribution of those determinants (fig. 1). In equally distributed populations, the structural cell must contain at least 20 determinants.

Primary structural cell. The largest structural cell used at any one site (fig. 1).

Secondary structural cell. Any structural cell smaller than the

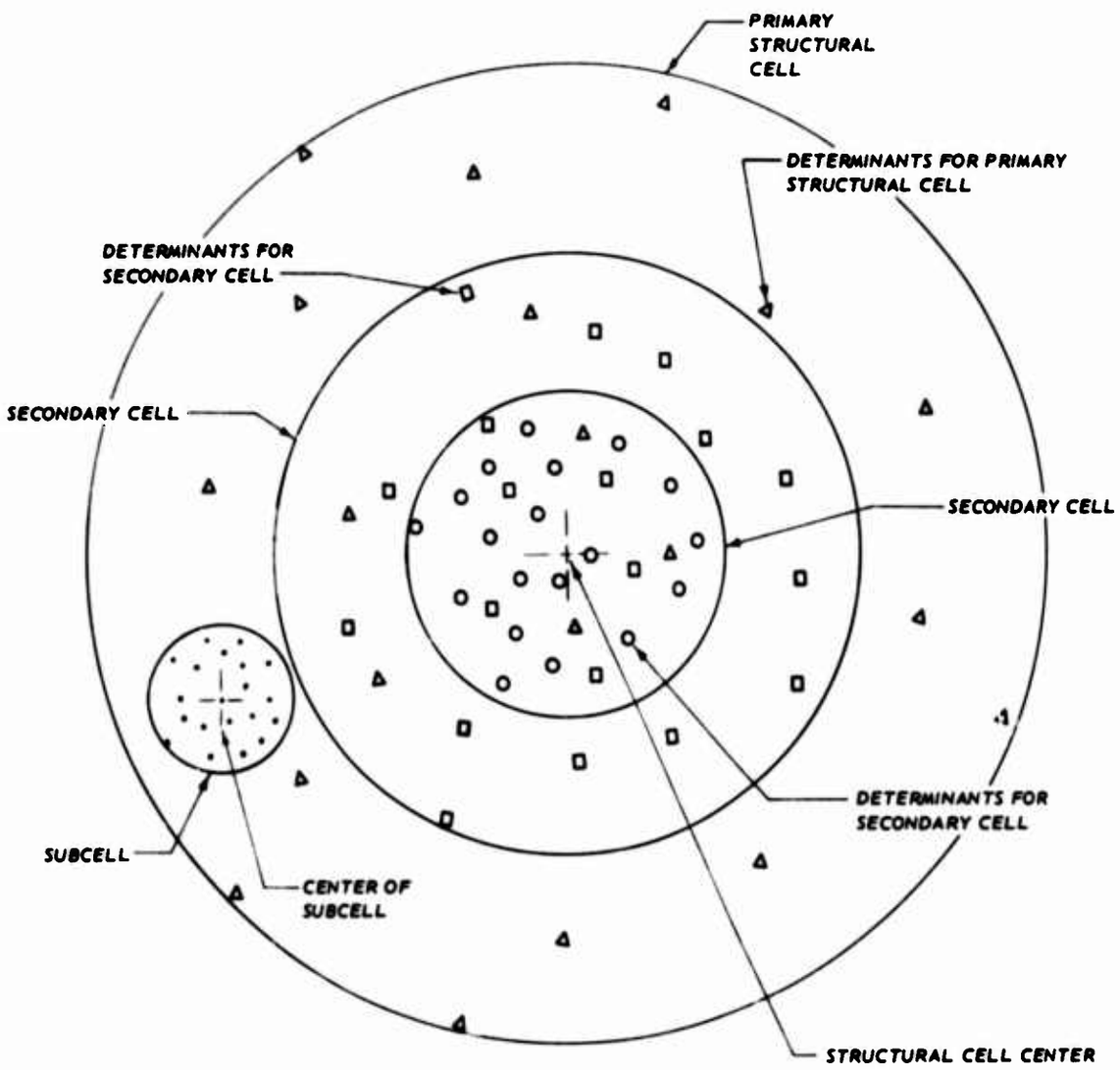


Fig. 1. Kinds of structural cells

primary cell and centered at the same place as the primary structural cell (fig. 1).

Subcell. A structural cell smaller than the primary cell but centered at a place within the primary structural cell other than the point on which the primary structural cell is centered (fig. 1).

Sample area. In a population of plants that is not equally distributed (for example, arranged in linear patterns, irregularly clustered, etc.), a structural cell cannot be established. Nevertheless, it is often important to describe such distributions. In such cases, a "sample area" is established; it is circular and of a completely arbitrary size chosen entirely by judgement.

Vegetation assemblage. All of the plants occurring in an area specifically delineated for description or study.

Terms Related to Data Recording

11. The information specified for collection by this manual is recorded almost entirely on forms designed for compatibility with ADP machines and methods. Since the data for any one vegetation description will consist of many data cards (or strips of magnetic tape), a number of reference and filing procedures are necessary in order to ensure easy retrieval and manipulation of the stored data. Terms used in a restrictive sense for this purpose are as follows:

Data form reference. The WES has designed a number of forms for in-the-field recording of data on various attributes of an environment. Each such form is assigned a reference number, which is printed in the lower left corner of the data sheet, usually in the following format:

WES Form No. 1664
Rev. Jan 1968

A catalog of WES forms is maintained, and a two-digit numerical code is assigned to each form pertinent to the environmental data collection manuals. This code is the "data form reference code."

Manual reference. Each of the environmental data collection manuals is assigned a two-digit reference number, which is the "manual reference number."

Factor family reference. Each factor family has been assigned a 1-digit reference number. The code is given in table 1.

Data group reference. There are normally several different data forms required to record all pertinent data for a specific factor family. In some instances, two or more of these forms are combined on a single WES form. The "data group reference" identifies the part of the form being used (and, therefore, the kind of data being recorded). The data group code is given in table 2.

Field. The column or columns in the data form reserved for a particular kind of information (see fig. 2).

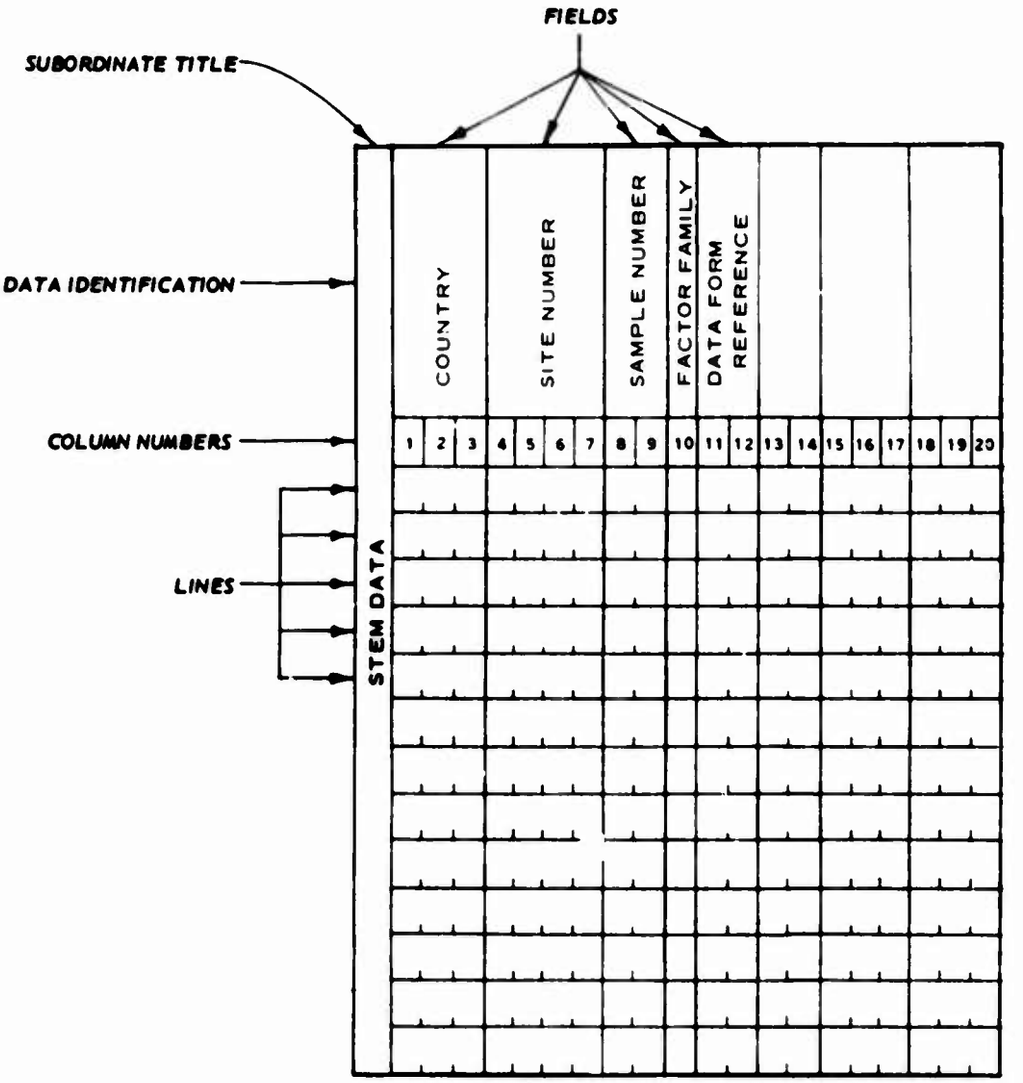


Fig. 2. Explanation of terms involving data forms

Table 1

Factor Family Reference Codes

Code	Factor Family
1	Surface composition
2	Hydrologic geometry
3	Surface geometry
4	Vegetation
5	Weather

Table 2

Data Group Reference Codes

Code	Data Group
01	Site location and identification
02	Topographic position of site
03	Site photography
04	Vegetation structure: stem
05	Vegetation structure: branch and foliage
06	Vegetation structure: crown
07	Nomenclature
08	Comments

Site number. The four-digit number assigned to each site selected for description. The numbers run from 0001 to 9999 within each country. Each site is assigned a number at the time it is established, and it retains that number for as long as the spot can be relocated exactly.

12. When the structural cell is used as the basis for establishing the size of a sample area, the area is fixed by the distribution of determinants. The determinant is the "thing" that is essentially equally distributed throughout the vegetation assemblage, and that has been chosen because it characterizes some pertinent attribute of that assemblage. The determinant can be a single factor value class (such as a stem diameter class) or it can be two or more factor value classes in combination. For example, an ecologist might be interested in the distribution of all plants having both spiny leaves and multiple stems. In this case, the "presence of spiny leaves" and "more than one stem" are together the determinant. If components displaying this combination are essentially equally distributed, a circle large enough to encompass 20 such components is designated as a structural cell for that determinant, and only that determinant.

13. Although there are some notable exceptions, in many instances the tallest plants in an assemblage also exhibit the widest spacings. Thus, structural cells based on plant height are commonly, but by no means universally, used. The general procedure for establishing a primary cell is to locate an arbitrary point in the assemblage of interest and establish around that point a circle that includes at least 20 of the tallest plants. To select the tallest plants, the general procedure is to measure the tallest plant within a 5- to 10-m radius (depending on the size of the plants) of the point that was arbitrarily chosen as the center of the sample area. Normally then, the determinant is a height >90 percent of the height of the measured plant. Successive structural cells that take in all vegetation even down to the shortest herbs and seedlings can be established through the use of other plant height intervals as determinants. The height classes used and the number of cells in a sample area must be chosen by the field crew based on the purposes for which the area is being described.

PART III: PROCEDURES

General Contents of Instruction Modules

14. This manual consists chiefly of six "Instruction Modules." Each instruction module provides detailed information on the procedures that must be used to acquire the kind of data or information specified by that module. Tables and figures to which reference is made in each instruction module follow the text of that module, and are numbered sequentially for each module. For example, {T:2-1} refers to table 1 for Instruction Module 2, and [F:4-2] refers to figure 2 for Instruction Module 4. The general content of each of the instruction modules is described in the following paragraphs.

Instruction Module 1: Site Location and Identification

15. The utility of even quantitative vegetation structure data is limited unless supporting information is also obtained. The absolute minimum of such data must include the geographic position of the site. Since it is likely that reference will need to be made to the site at some time in the future, it is essential that the location of the site be recorded with such accuracy that it can be relocated at any time. Instruction Module 1 provides detailed instructions for establishing and recording the site location and site identification.

Instruction Module 2: Topographic Position of Site

16. It is often important to know the position of the site with respect to the geometry of the surrounding topographic surface. The profile of the surface on which the site is located is obtained from a rough ground survey, a topographic map, or from air photographs. Details for obtaining and recording the required information are contained in Instruction Module 2.

Instruction Module 3: Site Photography

17. If properly composed, taken, and recorded, photographs of a site can provide a wealth of information not easily obtained in any other way. Photographs should be taken prior to the actual measurement of structural characteristics (i.e., prior to the implementation of

Instruction Module 4) in order to obtain a record of the appearance before any trampling or other modification of the structure occurs. Instruction Module 3 contains detailed instructions for taking and recording appropriate photographs.

Instruction Module 4: Vegetation Structure

18. A plant assemblage can be considered to be a collection of geometric objects arranged in a three-dimensional space. Although the total geometry may be extremely complex, it is possible to consider the various segments of the total array as independent entities and to describe them in terms of their separate geometries. The sum of these entities and their geometric positions with respect to each other comprise the structure of the assemblage. The procedure for obtaining and recording the requisite data are included in Instruction Module 4.

19. It is possible that some components of the vegetation assemblage at a particular site cannot be properly described through use of the procedures presented in Instruction Module 4. In such cases, provision has been made for recording supplemental information (see paragraph 21).

Instruction Module 5: Plant Nomenclature

20. Although it is not expected that field technicians should become experts in plant nomenclature, the names of the plants at a site should be obtained when possible. Normally, data relevant to plant nomenclature will be obtained only when a trained botanist is present. The information that should be determined and the format in which it must be recorded are presented in Instruction Module 5.

Instruction Module 6: Comments

21. Because it is impractical to provide instructions for all possible contingencies, provision has been made to record supplemental data of all kinds. These may include structural details that are not included in the standard instructions (Instruction Module 4), data on plant nomenclature that are in a form not amenable to the prescribed format (Instruction Module 5), comments concerning site conditions, or any other matter of interest or concern. These bits of information must, of course, be recorded in a nonstandard format, since there is no way of anticipating the supplemental data requirements for any particular situation. General

instructions for recording such information are given in Instruction Module 6.

Preliminary Precautions

22. In many cases it may be necessary or desirable to obtain data relevant to other factor families (i.e., surface geometry, surface composition, etc.) at the vegetation site. If such data are acquired, the data collection procedures should be in accordance with the WES data collection manuals for those factor families (see INDEX OF VOLUMES inside front cover).

23. Before going into the field to visit a site, it is important that the following things be done:

a. Obtain the best available maps and/or air photographs of the area around the site. They will not only aid in fixing the position of the proposed sites (Instruction Module 1), but will also assist in determining the proper location for the topographic profile (Instruction Module 2), and provide insight into site accessibility, general regional characteristics, and so on.

b. Make certain that all necessary equipment has been assembled. Use table 3 as a checklist.

c. Note and record the last site number used. This will be needed in order to assign a number to the sites that will be established during the current field exercise. If one or more of the sites has been visited previously, record the number of times that visits have been made. This information will be needed to fill out the data forms properly.

Organization of Instruction Modules

24. Each instruction module (see table 4) consists of a step-by-step description of the procedure that is to be followed in order to obtain and record the data. Each module consists of the following elements:

a. An introductory paragraph or paragraphs, citing matters of particular concern with respect to that module. These paragraphs are not numbered; they are identified by a sequence of upper-case letters (i.e., A, B, etc.).

b. Side headings, which are underlined and always printed in

two lines. The top line is the title of the WES data form that is to be used to record the data specified in the following items (see subparagraph 24c below). In some instances, more than one form is printed on a single sheet under a common title. In such cases, each form is given a subordinate title, which is printed along the left margin of the form (fig. 2). In the instruction modules, the subordinate title is located immediately after the primary data form title, but separated from it by a colon. The hyphenated number in brackets at the end of this line identifies the figure number of an example of the data form. The second line gives the WES data form reference information.

c. Data items (hereafter called items), which are numbered sequentially and contain detailed procedures for acquiring specific bits of data and for recording those data in the form specified by the preceding side heading (see subparagraph 24b above). Each item is presented in a standard format, each element of which is described in table 4.

d. Notes, which are interspersed among the sequentially numbered items (subparagraph 24c above). Notes are restricted to: (1) instructions for actions of which no record is kept on the data forms; (2) instructions for actions involving more than one kind of data; or (3) general comments on data acquisition or recording procedures, especially those covering more than one item.

Table 3

Suggested Equipment List for Vegetation Sampling

Item Name	Study Phases 1 Site Location and Identification	2 Topographic Position of Site	3 Site Photography	4 Vegetation Structure	5 Plant Nomenclature
Topographic maps of area	x	x			
Aerial photographs of area	x	x			
Hand level, Brunton-type compass, or site-marker transit		x	x	x	
Brunton-type compass or site-marker transit with compass				x	
Tripod for transit/Brunton-type compass		x	x	x	
Telescoping range pole, metric		x	x	x	
Camera, film			x		
Camera tripod, stereo frame			x		
Photo record book			x		
2-m steel tape			x		
30-m metallic tape				x	
Diameter tape, metric				x	
Haga-type altimeter				x	
Millimeter scale				x	
Clinometers (2)				x	
High-visibility spray paint	x	x	x	x	
Metal stakes, 1 by 50 cm	x				
Hammer	x	x	x	x	
Instruction manual	x	x	x	x	x
Vegetation data form pad	x	x	x	x	x
Pencils, paper	x	x	x	x	x
Clipboard	x	x	x	x	x

Table 4

Format of Instruction Modules

Number of instruction module

Title of Instruction Module

A. Introductory paragraph

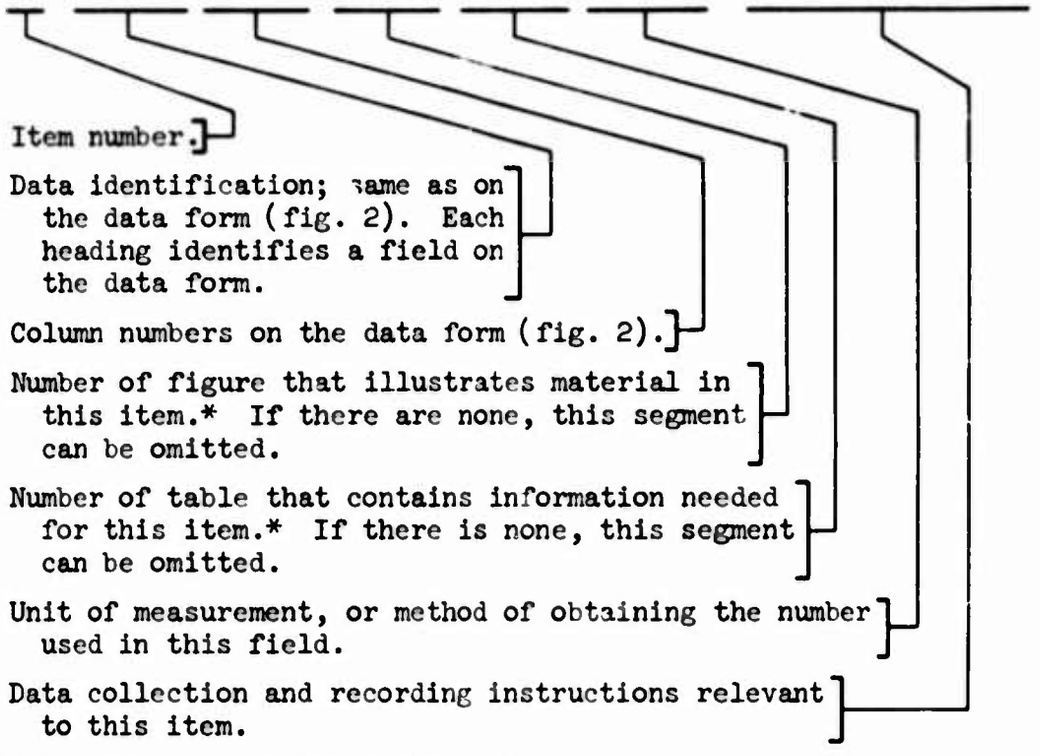
B. Introductory paragraphs (as needed)

Title of WES data form [F:] (i.e., Vegetation Structure [F:4-1])

WES data form reference (i.e., WES Form No. 1666, Rev. Dec 1966)

C. Introductory paragraph (as needed):

1. Heading ( ) [F:] {T: } | |: Text .....



NOTES: Text containing general instructions, etc.

2. (Additional items as needed.)

* When referring to a figure in the main text, the format is as follows:

[F:1] indicates fig. 1 in main text.

{T:1} indicates table 1 in main text.

Instruction Module 1

SITE LOCATION AND IDENTIFICATION

A. The purpose of this instruction module is to provide detailed instructions for the acquisition and recording of those data required to fix the location of the site with sufficient accuracy that it can be relocated at any reasonable time in the future. The best available air photographs and topographic maps should be obtained before going to the area of a prospective site.

Site Location and Identification [F:1-1]

WES Form No. 1664, Rev. Jan 1968

B. After selection of the site, record the following items in the specified sequence:

1. Country (1-3) {T:1-1} |code|: Select the assigned code number from the table. For example, the number of the United States is 141.
2. Site number (4-7) |count|: Within a given country, sites are numbered consecutively from 0001 to 9999. Record the number next in sequence after the last site number used.
3. Sample number (8-9) |count|: Indicate the number of times the site has been described. Place 01 in this field on the first visit, 02 on the second, and so on.
4. Factor family (10) {T:1} |code|: Refer to the table, and enter the appropriate code in this field. Since the site under study is a vegetation site, the appropriate number is 4.
5. Data form reference (11-12) |code|: The data form reference is preprinted on the data form.
6. Data group reference (13-14) |code|: The data group reference is preprinted on the data form.
7. Data manual reference (15-16) |code|: The data manual reference is preprinted on the data form.
8. Day (17-18) |count|: The day of the month on which the site was sampled. Thus, the second day of the month would be recorded as 02.

9. Month (19-20) |code| The month in which the site was sampled. Thus, the month of June would be recorded as 06.

10. Year (21-22) |count|: The last two digits of the year in which the site was sampled. Thus, 1968 would be recorded as 68.

11. State (23-25) {T:1-2} |code|: Record the code number that has been assigned to the secondary political subdivision of the country in which the site is located. Provinces, departments, amphoes, etc., are considered to be "states." The code for the states of the United States is given in the table. If numbers have not been assigned, place 000 in this field.

12. Location sketch (26) [F:1-1] |code|: Locate the site on the map and/or air photographs as closely as possible. If the location of the site cannot be transferred from the real world to the maps and/or air photographs with an accuracy of less than 30 m, make a sketch map of the immediate vicinity in such detail as to permit another person to relocate the site at any reasonable time in the future. An example of such a sketch is given in the figure. If such a sketch is made, place a 1 in this field; if none is made, place a 0 in the field. Space for the sketch map is provided on the data form. Note that on the sketch map the site is annotated with the factor family code number (vegetation = 4) and the site number (1076). The two codes are separated by a hyphen (i.e., 4-1076), as indicated in the figure. Drawing a sketch does not relieve the recorder of the requirement for recording either (or both) geographic coordinates or military grid coordinates (see following NOTE and items 13-24).

NOTE: The location of a site can be specified by the geographic coordinate system (degrees, minutes, and seconds of latitude and longitude) and/or by the Military Grid Reference System (MGRS). The geographic coordinate system is preferred, but either is acceptable. Details concerning the utilization of both systems can be found in "Map Reading," Department of the

Army FM 21-26, Oct 1960. If the coordinates of only one system are used, place 0 in all columns of all fields devoted to the other system. That is, if only the geographic coordinate system is used, place a 0 in columns 42-57, which are devoted to the MGRS. If a site cannot be located exactly (as often happens in forested country, for example), locate the general area and record the coordinates of the closest approximation. In such cases a sketch map is essential (see item 12).

13. Longitude degrees (27-29) [F:1-2] |degrees|: Record the longitude in degrees in this field.
14. Longitude minutes (30-31) [F:1-2] |minutes|: Record the minutes of longitude in this field.
15. Seconds longitude (32-33) [F:1-2] |seconds|: Record the seconds of longitude in this field.
16. East or west (34) [F:1-2] |code|: If the location is east longitude, place a 1 in this field; if west longitude, place a 2 in this field.
17. Latitude degrees (35-36) [F:1-2] |degrees|: Record the latitude in degrees in this field.
18. Latitude minutes (37-38) [F:1-2] |minutes|: Record the minutes of latitude in this field.
19. Latitude seconds (39-40) [F:1-2] |seconds|: Record the seconds of latitude in this field.
20. North or south (41) [F:1-2] |code|: If the location is north of the equator, place a 3 in this field; if south of the equator, place a 4 in this field.
21. Military grid zone designation (42-45) [F:1-2] |code|: The MGRS zone designation consists of one or two digits and a letter. Place the digits in columns 42-43. Convert the letter to a numerical code in accordance with the following tabulation:

A - 01	E - 05	I - 09	M - 13	Q - 17	U - 21	Y - 25
B - 02	F - 06	J - 10	N - 14	R - 18	V - 22	Z - 26
C - 03	G - 07	K - 11	O - 15	S - 19	W - 23	
D - 04	H - 08	L - 12	P - 16	T - 20	X - 24	

Record the two digits thus obtained in columns 44-45.

22. 100,000 m square designation (46-49) [F:1-2] |code|: This designation consists of two letters. They can be found in the grid reference box on the map sheet; in the figure, the 100,000 m square designation for the site (the geometric center of Gentry Cemetery) is ES. Code the two letters in accordance with the tabulation in item 21 on the preceding page, and place the code (0519) in this field.

23. Grid coordinate right (50-53) [F:1-2] |m|: Place the two digits of the grid designator that is printed in large type along the bottom (or top) of the map sheet in columns 50-51. Measure the distance (in tens of meters) from the grid line thus designated to the site, and record the number in columns 52-53.

24. Grid coordinate up (54-57) [F:1-2] |m|: Place the two digits of the grid designator that is printed in large type along the sides of the map sheet in columns 54-55. Measure the distance (in tens of meters) from the grid line thus designated to the site, and record the number in columns 56-57.

25. AMS map series (58-62) [F:1-2] |code|: In most cases, the AMS map series identification consists of a letter and two or three numbers. Place the numerical code for the letter (see tabulation in item 21) in columns 58-59. Place the numerical code in columns 60-62; if there are only two digits, place a 0 in column 60. For example, the AMS map series of the map used in the example is V853. Place the numerical code for V (22) in columns 58-59, and 853 in columns 60-62.

26. Comments (63) |code|: Place a 1 in this field. On the "Comment" data form, record the last name of the team leader in conformity with the instructions given in Instruction Module 6. If it is also desired to record the reference maps and/or air photographs that were used, write out a

complete reference to the map or photograph on the "Comment" data form, using as many lines as required.

NOTE: The minimum required information for a map consists of the following:

Date of publication
Sheet title (including number, if any)
Map series number (if any)
Issuing agency or organization
Scale

The minimum required information for an air photograph consists of the following:

Photograph number
Roll number
Date mission was flown
Scale
Originating agency or company

This information should be written out clearly, with a minimum of abbreviations. For example: April 1964, Fort Knox, Kentucky, Sheet No. 3859 IV NW, AMS series V853, 1:50,000, NOT 4 64 Ft Knox Ky 3859 IV NW V853. If the information requires more than one line, continue on the next line. See Instruction Module 6 for details.

T:1-1

Numerical Codes for the Countries of the World

Code	Country
001	Aden
002	Afghanistan
003	Albania
004	Algeria
005	Angola
006	Argentina
007	Australia
008	Austria
009	Bahrein
010	Basutoland
011	Bechuanaland
012	Belgium
013	Bhutan
014	Bolivia
015	Brazil
016	British Guiana
017	British Honduras
018	British North Borneo
019	Bulgaria
020	Burma
021	Burundi
022	Cambodia
023	Cameroon
024	Canada
025	Central African Republic
026	Ceylon
027	Chad
028	Chile
029	China, Communist
030	China, Nationalist
031	Colombia
032	Congo, Republic of the (Brazzaville)
033	Congo, Democratic Republic of the (Leopoldville)
034	Costa Rica
035	Cuba
036	Cyprus
037	Czechoslovakia
038	Dahomey
039	Denmark
040	Dominican Republic
041	Ecuador
042	Egypt (United Arab Republic)
043	El Salvador
044	England
045	Ethiopia
046	Finland
047	France
048	French Guiana
049	French Somaliland
050	Gabon Republic

(Continued)

T:1-1 (Continued)

Code	Country
051	Gambia
052	Germany, East
053	Germany, West
054	Ghana
055	Greece
056	Greenland
057	Guatemala
058	Guinea
059	Haiti
060	Honduras
061	Hungary
062	Iceland
063	India
064	Indonesia
065	Iran
066	Iraq
067	Ireland, Republic of (Eire)
068	Israel
069	Italy
070	Ivory Coast
071	Jamaica
072	Japan
073	Jordan
074	Kenya
075	Korea, North
076	Korea, South
077	Kuwait
078	Laos
079	Lebanon
080	Liberia
081	Libya
082	Luxembourg
083	Malagasy Republic (Madagascar)
084	Malawi (Nyasaland)
085	Malaya
086	Mali
087	Mauritania
088	Mexico
089	Mongolian People's Republic
090	Morocco
091	Mozambique
092	Muscat and Oman
093	Nepal
094	Netherlands
095	New Guinea and Papua, Territory of
096	New Zealand
097	Nicaragua
098	Niger
099	Nigeria
100	Northern Ireland

(Continued)

T: 1-1 (Concluded)

Code	Country	Code	Country
101	Norway	126	Surinam
102	Pakistan	127	Swaziland
103	Panama	128	Sweden
104	Paraguay	129	Switzerland
105	Peru	130	Syria
106	Phillipines	131	Tanzania
107	Poland	132	Thailand
108	Portugal	133	Tibet
109	Puerto Rico	134	Togo
110	Qatar	135	Trinidad and Tobago
111	Rhodesia	136	Trucial States
112	Rumania	137	Tunisia
113	Rwanda	138	Turkey
114	Sarawak	139	Uganda
115	Saudi Arabia	140	U.S.S.R.
116	Scotland	141	United States
117	Senegal	142	Upper Volta
118	Sierra Leone	143	Uruguay
119	Singapore	144	Venezuela
120	Somali Republic	145	Vietnam, North
121	South Africa, Republic of	146	Vietnam, South
122	South-West Africa	147	Virgin Islands
123	Spain	148	Wales
124	Spanish Sahara	149	Yemen
125	Sudan	150	Yugoslavia
		151	Zambia

T:1-2

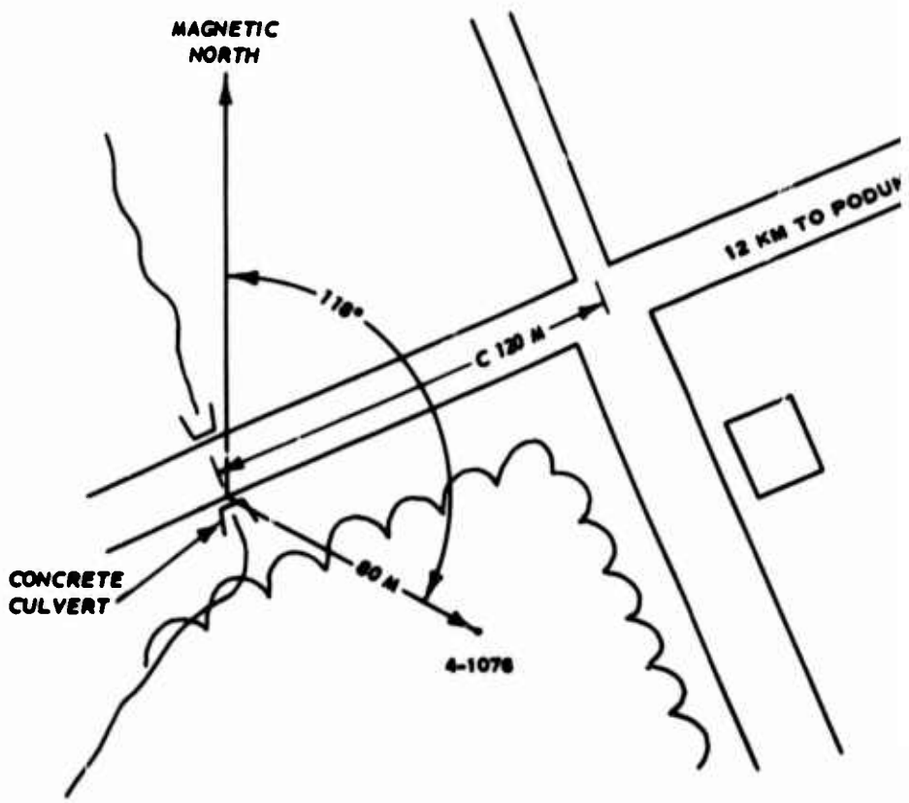
Numerical Codes for States in the United States

Code	State	Code	State
001	Alabama	026	Montana
002	Alaska	027	Nebraska
003	Arizona	028	Nevada
004	Arkansas	029	New Hampshire
005	California	030	New Jersey
006	Colorado	031	New Mexico
007	Connecticut	032	New York
008	Delaware	033	North Carolina
009	Florida	034	North Dakota
010	Georgia	035	Ohio
011	Hawaii	036	Oklahoma
012	Idaho	037	Oregon
013	Illinois	038	Pennsylvania
014	Indiana	039	Rhode Island
015	Iowa	040	South Carolina
016	Kansas	041	South Dakota
017	Kentucky	042	Tennessee
018	Louisiana	043	Texas
019	Maine	044	Utah
020	Maryland	045	Vermont
021	Massachusetts	046	Virginia
022	Michigan	047	Washington
023	Minnesota	048	West Virginia
024	Mississippi	049	Wisconsin
025	Missouri	050	Wyoming

SITE LOCATION AND IDENTIFICATIO

COUNTRY	SITE NUMBER	SAMPLE NUMBER	FACTOR FAMILY	DATA FORM REFERENCE	DATA GROUP REFERENCE	DATA MANUAL REFERENCE	DAY	MONTH	YEAR	STATE	LOCATION SKETCH	LONGITUDE DEGREES	LONGITUDE MINUTES	LONGITUDE SECONDS	EAST OR WEST	LATITUDE DEGREES	LATITUDE MINUTES	LATITUDE SECONDS	NORTH OR SOUTH	MILITARY GRID ZONE DESIGNATION	100,000 M SQUARE IDENTIFICATION
1 2 3	4 5 6 7	8 9	10	11 12	13 14	15 16	17 18	19 20	21 22	23 24 25	26	27 28 29	30 31	32 33	34	35 36	37 38	39 40	41	42 43 44 45	46 47 48
				1,0	0,1	1,0															
				1,0	0,1	1,0															
				1,0	0,1	1,0															

LOCATION SKETCH



WES FORM NO. 1664
REV JAN 1968

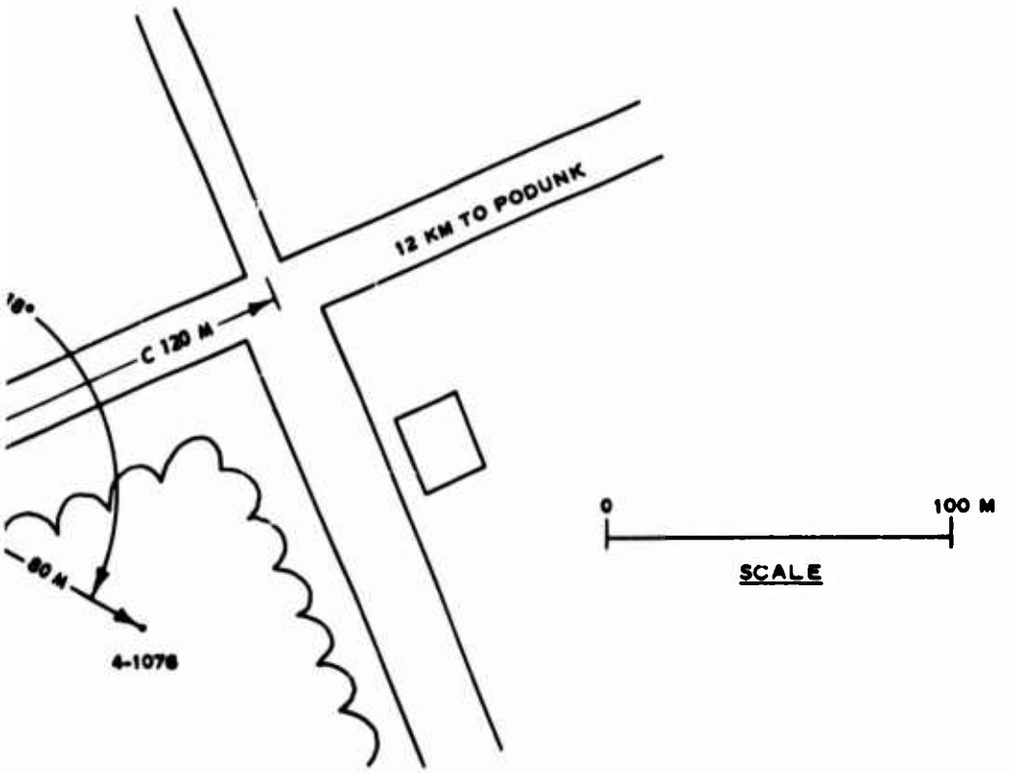
F:1-1. Vegetation site location and identification data form

A

SITE LOCATION AND IDENTIFICATION

LONGITUDE MINUTES	LONGITUDE SECONDS	EAST OR WEST	LATITUDE DEGREES	LATITUDE MINUTES	LATITUDE SECONDS	NORTH OR SOUTH	MILITARY GRID ZONE DESIGNATION	100,000 M SQUARE IDENTIFICATION	GRID COORDINATES RIGHT	GRID COORDINATES UP	AMS MAP SERIES	COMMENTS
31	32 33	34	35 36	37 38	39 40	41	42 43 44 45	46 47 48 49	50 51 52 53	54 55 56 57	58 59 60 61 62	63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

LOCATION SKETCH



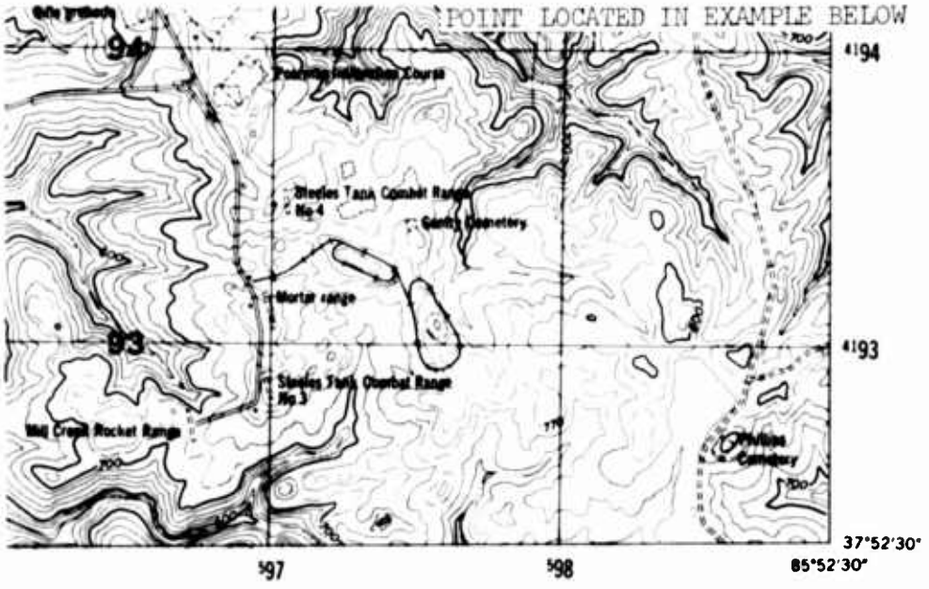
cation and identification data form and example of location sketch

B

REFER TO THIS MAP AS:

SHEET 3859 IV NW

SERIES V853



GRID ZONE DESIGNATION 16S	TO GIVE A STANDARD REFERENCE ON THIS SHEET TO NEAREST 100 METERS
100 000 M SQUARE IDENTIFICATION: ET / ES, 4200	SAMPLE POINT INDIAN MOUND
	1. Locate first VERTICAL grid line to LEFT of point and read LARGE figures labeling the line either in the top or bottom margin, or on the line itself. Estimate tenths from grid line to point. — 88 5
	2. Locate first HORIZONTAL grid line BELOW point and read LARGE figures labeling the line either in the left or right margin, or on the line itself. Estimate tenths from grid line to point. — 04 4
IGNORE the SMALLER figures of any grid number these are for finding the full coordinates. Use ONLY the LARGER figures of the grid number example 4193000	SAMPLE REFERENCE — 885044
	If reporting beyond 100 000 meters or if sheet bears an overlapping grid prefix 100 000 Meter Square Identification as — ET885044
	If reporting beyond 18° in any direction prefix Grid Zone Designation as — 16SET885044

LOCATION CODE FOR MIDDLE OF GENTRY CEMETERY (PORTION OF WES FORM NO. 1664)

LONGITUDE DEGREES	LONGITUDE MINUTES	LONGITUDE SECONDS	EAST OR WEST	LATITUDE DEGREES	LATITUDE MINUTES	LATITUDE SECONDS	NORTH OR SOUTH	MILITARY GRID ZONE DESIGNATION	100,000 M SQUARE IDENTIFICATION	GRID COORDINATES RIGHT	GRID COORDINATES UP	AMS MAP SERIES
27 28 29	30 31	32 33	34	35 36	37 38	39 40	41	42 43 44 45	46 47 48 49	50 51 52 53	54 55 56 57	58 59 60 61 62
0 8 5	5 3	3 0	2	3 7	5 3	0 6	3	1 6 1 9	0 5 1 9	9 7 4 8	9 3 4 1	2 2 8 5 3

F:1-2. Illustration of site location record

Instruction Module 2

TOPOGRAPHIC POSITION OF SITE

A. The purpose of this instruction module is to provide instructions for the acquisition and recording of data from which an elevation profile through the site can be constructed. The intent is to be able to define the topographic relations of the site with respect to the adjacent topographic high (i.e., the top of the adjacent hill or ridge) and topographic low (i.e., swale or drainage line). A horizontal and vertical accuracy of approximately 5 percent is acceptable; this is the approximate accuracy that can be achieved with a hand level and Philadelphia rod.

B. The topographic profile line is a straight line originating at the crest of the adjacent topographic high (if any) and passing through the site to a terminus in the adjacent topographic low (F:2-2). Only rarely will this line approximate the line of flow of water from topographic high to topographic low; in most cases it will only roughly approximate the line of flow. In some cases, there may be no perceptible topographic highs or lows near the site, or there may be cases in which those highs and lows, while plainly apparent, are an inordinate distance away. In such cases, carefully read the special instructions in the NOTE following item 7.

Topographic Position of Site [F:2-1]

WES Form No. 1665, Rev. Jan 1968

C. After selection of the topographic profile line, record the following data in the specified sequence:

1. Country (1-3) {T:1-1} |code|: Record the code number of the country in which the site is located.
2. Site number (4-7) |count|: Within a given country, sites are numbered consecutively from 0001 to 9999. Be certain that the number placed in this field is the same as the number that was placed in the same field on WES Form No. 1664 (F:1-1).
3. Sample number (8-9) |count|: Indicate the number of times the site has been sampled. Place 01 in this field in the first visit, 02 on the second, and so on.

4. Factor family (10) {T:1}|code|: Refer to the table, and put the appropriate code in this field. Since the site will in this case be a vegetation site, the proper code is 4.
5. Data form reference (11-12) |code|: The data form reference number is preprinted on the data form.
6. Data group reference (13-14) |code|: The data group reference number is preprinted on the data form.
7. Line number (15-17) |count|: On the first line used, place 001 in this field, and number successive lines sequentially.

NOTE CONCERNING UNUSUAL PROFILES: In most cases there will be an obvious topographic high and low near the site. In such cases, proceed as indicated in items 8-33. If there is a topographic high or low obviously present, but the closest one is more than 200 m from the site, follow the procedure given in items 8-33, but follow the special instructions in brackets in items 8 and 9, and in the NOTE following item 31. All other instructions (items 10-33) remain the same. However, in the event that there is no obvious topographic high or low within 200 m of the site, proceed immediately to the NOTE following item 33, and continue from that point.

8. Profile azimuth (18-20) [F:2-2] |degrees|: Record the magnetic azimuth of the profile line in degrees. Magnetic azimuth is always measured clockwise from magnetic north. Stand at the site center, locate the point at which the profile line crosses the adjacent topographic high, and record the azimuth to that point. Magnetic north is recorded as 360°, not 0°. [If a topographic high is not encountered within 200 m upslope from the site, establish the origin of the profile at a point 200 m from the site. In this case, obviously the origin need not be at the crest of a hill or ridge. Record the azimuth as described above. The profile will run in straight line from the origin through the site to either a point 200 m beyond the site, or to a topographic low, whichever occurs first.]
9. Elevation of origin (21-26) [F:2-2] |cm|: Record the

elevation of the point at which the profile line crosses the adjacent topographic high. If this point is estimated from a map, record the value to the nearest meter, if possible (in which case zeros would be recorded in columns 25 and 26). If no information on elevation can be obtained, record any arbitrary value, but try to estimate the proper order of magnitude. [If the site is based on the 200-m rule (see NOTE following item 7), record the elevation of the origin, as established in the instructions in brackets in item 8. Instructions for recording are the same as for a standard profile.]

10. Source of estimate (27) |code|: Record the source of the value recorded in columns 21-26 according to the following code:

    1 Measured from bench mark or other established reference

    2 Estimated from topographic map

    3 Uncontrolled estimate

NOTE CONCERNING SETTING UP AN INSTRUMENT: Set up the instrument that will be used to establish the horizontal lines of sight required to obtain the topographic profile data. The most commonly used is a site-marker transit. However, other instruments, such as an engineer's level, theodolite, or telescopic alidade and plane-table can be used. If such intruments are not available, even a simple hand level can be used.

11. Height of instrument (28-30) [F:2-2] |cm|: Measure and record the vertical distance from the ground surface to the horizontal axis of the instrument. The first instrument station is always at the origin of the profile line.

12. Horizontal distance (31-36) [F:2-2] |cm|: Measure the horizontal distance from the instrument (position 000000; i.e., the point at which the profile line crosses the topographic high) to a point on the profile line downslope from the origin. The point should be selected at a position where the topographic slope "breaks" (i.e., obviously changes to

either a steeper or more gentle slope). If for any reason this is impractical, select any convenient spot, but all points of significant slope change must be recorded.

13. Rod reading (37-39) [F:2-2] |cm|: Place the Philadelphia rod on the point selected in item 12. Sight the instrument along a horizontal line, and record the rod reading in this field.

NOTE: At or about this point several possible conditions may occur, each of which involves a slightly different procedure. The following possibilities can occur:

a. The next rod position is farther down the slope along the profile line, but still in such position that the rod can be read. The instrument is not moved. In this event, the procedure is as follows:

14. Country.....Height of instrument (1-30): Copy all numbers (except that in the 15-17 field) in the first line into the second line. The number in the 15-17 field will increase by one. At the same time, place 0 in columns 40-48 in the first line (i.e., the "Site Center Distance" and "Instrument Change Rod Reading" fields). Leave columns 49-51 empty in the first line.

15. Horizontal distance (31-36) [F:2-2] |cm|: In the second line, record the horizontal distance between the first rod position (i.e., that recorded in the preceding line) and the second rod position (i.e., that position just established).

16. Rod reading (37-39) [F:2-2] |cm|: In the second line, record the rod reading with the rod at the second rod position (i.e., that position just established).

Continue this process as many times as necessary, until one of the conditions described below occurs. Be sure to place 0 in columns 40-48 in all lines in which those fields are not used (i.e., in which no measurement involves an instrument position change or the center of the site.

b. The center of the structural cell or sample area occurs before

the next significant slope change. The instrument is not moved. In this event, the procedure is as follows:

17. Country.....Height of instrument (1-30): Copy all numbers (except those in the 15-17 field) in the preceding line into the next line. The number in the 15-17 field will increase by one.
18. Horizontal distance (31-36) [F:2-2] |cm|: Enter 000000 in this field.
19. Rod reading (37-39) [F:2-2] |cm|: Place the rod at the site center, and record the rod reading in this field.
20. Site center distance (40-45) [F:2-2] |cm|: Measure the horizontal distance from the last rod position to the present rod position (at the center of the site), and record the value in this field.

c. The next break in slope is so far down the profile that the rod can no longer be read, making it necessary to change the position of the instrument. In this event, the procedure is as follows:

21. Country.....Source of estimate (1-27): Copy all numbers (except that in the 15-17 field) in the preceding line into the next line. The number in the 15-17 field will increase by one.
22. Height of instrument (28-30) |cm|: Place 000 in this field.
23. Instrument change rod reading (46-48) [F:2-2] |cm|: Move the instrument from its first position to a new position downslope, from which a horizontal line of sight will intercept the rod held at its last position, preferably at a point near its base (i.e., so that the rod reading from the new instrument position will be low). Read the rod from the new instrument position, and record the value in this field.
24. Horizontal distance (31-36) [F:2-2] |cm|: Move the rod to the next downslope change in slope. Measure the horizontal distance between the first rod position (i.e., that used

in item 23 on the preceding page) and the new rod position. Record the value in this field.

25. Rod reading (37-39) [F:2-2] |cm|: Read the rod at the position used for item 24, and record the value in this field. Record 000000 in the "Site Center Distance" field (columns 40-45).

d. The center of the structural cell or sample area occurs before the next break in slope, but so far down the slope that the rod cannot be read. This requires a change in the position of the instrument. In this event, the procedure is as follows:

26. Country.....Source of estimate (1-27): Copy all numbers (except that in the 15-17 field) in the preceding line into the next line. The number in the 15-17 field will increase by one.

27. Height of instrument (28-30): Place 000 in this field.

28. Instrument change rod reading (46-48) [F:2-2] |cm|: Move the instrument from its first position to a new position downslope, preferably in such a place that a horizontal line of sight will intercept the rod, held at its last position, at a point near its base. Read the rod from the new instrument position, and record the value in this field.

29. Horizontal distance (31-36): Place 000000 in this field.

30. Site center distance (40-45) [F:2-2] |cm|: Move the rod to the center of the structural cell or the sample area. Measure the horizontal distance between the previous rod position (item 28 above) to the present rod position, and record the value in this field.

31. Rod reading (37-39) [F:2-2] |cm|: Read the rod, held at the site center (i.e., the center of the structural cell or the sample area), and record the value in this field.

NOTE: Continue the process of measuring pairs of horizontal distances (rod positions) and vertical distances (rod readings) until the last rod position is at the bottom of the adjacent topographic low. It is assumed

that the last recorded position is in fact at the topographic low, unless otherwise specified by a statement on a "Comment" card (see Instruction Module 6). [In the event that a topographic low is not reached at a distance equal to or less than 200 m from the site, place a 1 in the "Comment" field (column 52), and record the nature of the profile on the "Comment" data form (see Instruction Module 6). A convenient phrase is: SLOPE LENGTH EXCEEDS PROFILE LIMITS.]

32. Total number of lines (49-51) |count|: After the last rod reading has been obtained (i.e., the reading with the rod held at the topographic low), note the number in the "Line Number" field (columns 15-17) in the last line that was used, and record it in all lines in this field.

33. Comment (52) |code|: On the first line devoted to a site, place a 1 in this field. On the "Comment" data form (Instruction Module 6), record the last name of the leader of the team making the measurements. In addition, if for any reason it seems desirable to record supplementary information concerning the topographic position of the site, write out the additional information on the "Comment" data form in accordance with the instructions given in Instruction Module 6.

NOTE CONCERNING INDETERMINATE PROFILES: If there is neither an obvious topographic high or low within 200 m of the site, proceed as follows (and note example presented in line 8 of F:2-1).

34. Profile azimuth (18-20) [F:2-1] |degrees|: Stand at the center of the site, and with a hand level, check points at several azimuths at the effective perimeter of the circle of visibility (i.e., the distance at which an object can be clearly recognized). In some forests and scrub assemblages, this may be only a few meters. Select the point at which the smallest rod reading was obtained, and assume that point defines the direction of maximum slope. Measure the azimuth to that point, and record it in this field. If no difference in elevation can be noted

among the points selected, record 360 in this field.

35. Elevation of origin (21-26) [F:2-1] |cm|: Go out along the azimuth selected in item 34 for about 200 m; the point thus established is the origin of the profile line. Estimate the elevation of this point from the best visible source, and record the value in this field.

36. Source of estimate (27) [F:2-1] |code|: Record the source of the value recorded in item 35. Use the code given in item 10.

37. Height of instrument.....Instrument change rod reading (28-48) [F:2-1]: Follow the instructions given in items 11-33, as appropriate.

38. Total number of lines (49-51) [F:2-1] |count|: In this situation (i.e., no recorded profile data), only one line will be needed. Record 001 in this field.

39. Comment (52) [F:2-1] |code|: Place a 1 in this field. For additional instructions, see item 33.

TOPOGRAPHIC POSITION OF SIT

COUNTRY	SITE NUMBER	SAMPLE NUMBER	FACTOR FAMILY	DATA FORM REFERENCE	DATA GROUP REFERENCE	LINE NUMBER	PROFILE AZIMUTH	ELEVATION OF ORIGIN	SOURCE OF EST.	HEIGHT OF INSTRUMENT	HORIZONTAL DISTANCE	ROD READING	SITE CENTER DISTANCE	INSTRUMENT CHANGE
1 2 3	4 5 6 7	8 9	10	11 12	13 14	15 16 17	18 19 20	21 22 23 24 25 26	27	28 29 30	31 32 33 34 35 36	37 38 39	40 41 42 43 44 45	46 47
146	0001	01	4	10	02	001	270	000976	2	160	001950	200	000000	00
146	0001	01	4	10	02	002	270	000976	2	160	000850	280	000000	00
146	0001	01	4	10	02	003	270	000976	2	000	001005	270	000000	01
146	0001	01	4	10	02	004	270	000976	2	000	000000	285	001320	00
146	0001	01	4	10	02	005	270	000976	2	000	004400	150	000000	09
146	0001	01	4	10	02	006	270	000976	2	000	002900	220	000000	00
				10	02									
146	0002	01	4	10	02	001	000	001050	1	000	000000	000	000000	00
				10	02									
				10	02									
				10	02									
				10	02									
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				10	02									
				10	02									
				10	02									
				10	02									

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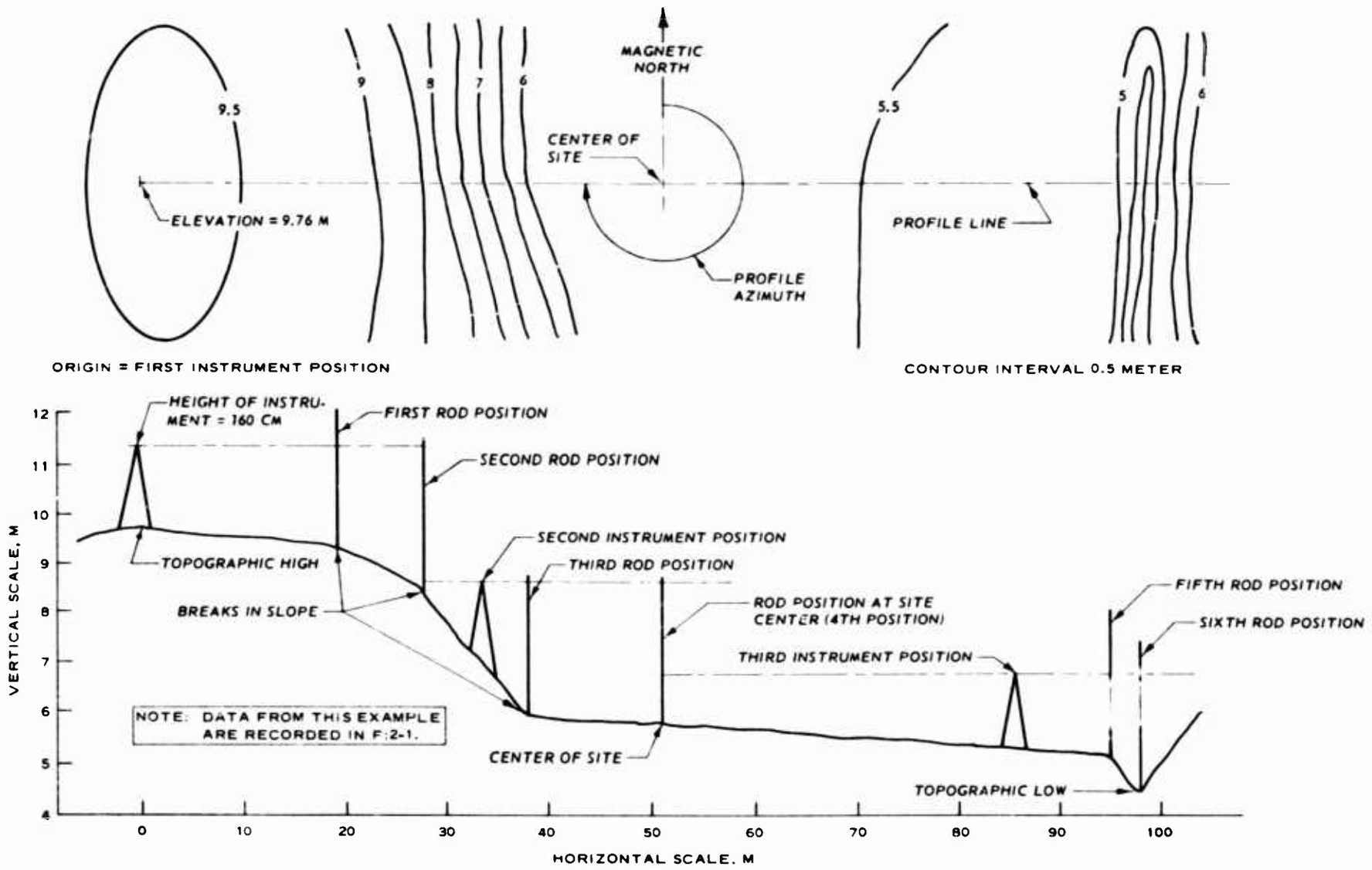
F:2-1. Topographic position of site

A

TOPOGRAPHIC POSITION OF SITE

HORIZONTAL DISTANCE (11–36)	ROD READING (37–39)	SITE CENTER DISTANCE (40–45)	INSTRUMENT CHANGE ROD READING (46–48)	TOTAL NUMBER OF LINES (49–51)	COMMENT (52)
001950	200	000000	000	006	0
000850	280	000000	000	006	0
001005	270	000000	010	006	0
000000	285	001320	000	006	0
004400	150	000000	095	006	0
000290	220	000000	000	006	0
000000	000	000000	000	001	1

1. Topographic position of site data form



F:2-2. Example of a profile line

SITE PHOTOGRAPHY

A. The objective of this module is to specify the procedures to be used to obtain useful photographs of vegetation assemblages. Photographs of vegetation structures often provide information about a site that can be obtained in no other way. It is important that the instructions be followed carefully so that both photographs and records will be compatible with the photograph storage and retrieval system of WES.

Record of Photographs [F:3-1]
WES Form No. 1669, Jan 1968

B. Considerable latitude in the taking of photographs of vegetation sites is permitted. The procedure specified below is one that is commonly used, but it must be understood that it can be amplified or abbreviated to any degree that the field team feels is appropriate.

1. Country (1-3) {T:1-1} |code|: Record the code number of the country in which the site is located.
2. Site number (4-7) |count|: Record the number that has been assigned to the site.
3. Sample number (8-9) |count|: Record the number of times the site has been sampled or described.
4. Factor family (10) {T:1} |code|: Record the number of the factor family to which the photographs refer. Since the site being examined is devoted to vegetation, the appropriate number is 4.
5. Data form reference (11-12) |code|: The data form reference number is preprinted on the data form.
6. Data group reference (13-14) |code|: The data group reference is preprinted on the data form.
7. Film type (15-16) {T:3-1} |code|: Record the code number of the type of film used for the picture.
8. Roll number (17-18) |count|: Record the number of the film roll or pack that has been exposed during the field exercise. If

Polaroid film or other sheet film is used enter 00 in the columns.

9. Exposure number (19-20) |count|: Record the number of the exposure on the roll.
10. Line number (21-22) |count|: Record the sequence of lines needed for photographs of a particular site. For the first photograph taken at a specific site, place 01 in this field, 02 for the second photograph, and so on. When a new site is photographed, start the sequence over again.
11. Stereopair companion (23-24) |code|: If this is the first half of a stereopair, record the next sequential number after the number that has been recorded in columns 21-22. For example, if the number in columns 21-22 is 06, place 07 in this field, and be certain that the next exposure is in fact the second half of the stereopair. If the exposure being made is not a part of a stereopair, record 00 in this field.
12. Lens focal length (25-27) |mm|: Record the focal length of the camera lens. This value is usually printed on the ring around the lens.
13. Interocular distance (28-30) [F:3-3] |mm|: If stereophotographs are taken using a tripod and stereo frame, record the horizontal displacement of the camera permitted by the stereo frame. If the exposure being made is not part of a stereopair, or is part of a hand-held stereopair, record 000 in this field.
14. Time (31-34) |hrs, min|: Record the time by the 24-hr military system. For example, 3:20 p.m. is recorded as 1520.
15. Day (35-36) |count|: Record the day of the month on which the photograph was taken.
16. Month (37-38) |code|: Record the code for the month in which the photograph was taken. For example, January = 01, February = 02, and so on.
17. Year (39-40) |count|: Record the last two digits of the

year in which the photograph was taken. For example, record 1968 as 68.

18. Location azimuth (41-43) [F:3-2] |degrees|: Select a spot beyond the perimeter of the structural cell or sample area. Point the camera approximately across the center of the site, but directed in such a way that the maximum amount of information about the assemblage is included in the frame. Stand at the center of the site, and measure the azimuth, clockwise from magnetic north, to the camera location. Record the azimuth in this field.

19. Location distance (44-47) [F:3-2] |cm|: Measure the horizontal distance from the center of the site to the camera position, and record the value in this field.

20. Camera azimuth (48-50) [F:3-2] |degrees|: Record the azimuth of the optical axis of the camera in this field.

21. Distance to scale (51-54) [F:3-2] |cm|: Be sure that a scale of some sort is shown in the photograph. It is much to be preferred if the scale is an object for which the size is accurately known; surveying rods and Philadelphia rods are ideal, but any other object, including people, is acceptable if a surveying rod or Philadelphia rod is not available. The scale should be placed in the middle distance, and in such a position that it will not obstruct the view. Measure the horizontal distance between the camera and the scale, and record the value in this field.

22. Tripod (55) |code|: If the camera is mounted on a tripod, place a 1 in this field. If the exposure was made with a hand-held camera, place a 0 in this field.

NOTE: After the preparations specified above have been made, make the exposure with due care.

NOTE CONCERNING STEREOPHOTOGRAPHY: If at all possible, stereopairs should be taken, since they provide much more information than a single photograph. Stereopairs that are satisfactory for general illustrations can be readily made with a hand-held camera. Stereopairs of sufficiently good

quality to permit reliable determinations of the size and spatial positions of objects can be obtained with a tripod-mounted camera. The techniques are as follows:

a. To obtain stereopairs with a hand-held camera, stand erect on the spot established in items 18 and 19 above. Focus the camera, and frame the subject squarely in the viewfinder. Observe the viewfinder image carefully, select one or more easily recognizable features in the image, and note the position of these features relative to the image frame. After taking the picture do not move the feet while advancing the film in the camera. When you are ready to take the second picture, sidestep, either left or right approximately 10 cm. Position the camera for photographing, and reframe the image exactly as before. Take the picture.

b. To obtain stereopairs with a mounted camera, set up the camera tripod and attach the stereo frame and camera [F:3-3]. Level the camera, using the level bubble built into the stereo frame. Move the camera to the right side of the stereo frame and make the first exposure. After making the exposure, advance the film and move the camera to the left side of the stereo frame. Make the second exposure. Note that stereopairs are two photographs, and each photograph of the pair requires a line on the data form. Be certain that items 9 and 10 are properly recorded.

23. Country.... Roll number (1-18): Copy all numbers in the preceding line into the line that will be used to record the second exposure.

24. Exposure number (19-20): Record the next sequential number of the next exposure in this field.

25. Line number (21-22): Record the next number in sequence after the one in the line above.

26. Stereopair companion (23-24): If the second exposure is the second half of a stereopair, copy the exposure number of the first half of the stereopair into this field. Example: If the number in columns 19-20 is 06, place 06 in this field. If the photograph being taken is not a part of a stereopair, record 00 in this field.

27. Lens focal length.... Distance to Scale (25-54): If the photograph being taken is the second half of a stereopair, copy all values from the line above into the line being used for this exposure. If the photo being taken is not a member of a stereopair, record the data appropriate to the new camera position in accordance with items 12-21 above.

NOTE CONCERNING CAMERA POSITIONS: If possible, at least two views should be taken across each site. Ideally the two views should have azimuths differing by about 90 degrees [F:3-2], although considerable latitude is acceptable. Additional photographs, preferably in stereopairs, should be taken to illustrate features of special significance, or to assist in the interpretation of the quantitative data taken in accordance with Instruction Module 4. Thus, there are two major reasons for taking photographs: to provide a general view of the site, and to illustrate special features. The distinction is recorded as follows:

28. Purpose (56) |code|: If the photograph was taken as a general view, place 0 in this field. If it was taken for a special purpose, place 1 in this field.

29. Total number of photographs (57-58) |count|: After all photographs of a site have been taken, count the number of lines devoted to the site, and record that number in this field in every line devoted to the site. This value can readily be obtained by copying the number in the "Line number" field (columns 21-22) in the last line used into this field.

30. Comment (59) |code|: On the first line devoted to a site, place a 1 in this field. On the "Comment" data form (Instruction Module 6), record the last name of the photographer. If there are appropriate comments to make about this photograph, write the comment out in accordance with Instruction Module 6. If comments are appropriate for other lines at a specified site, place a 1 in this field, and write out the comment on the appropriate data form, but omit the name of the photographer.

T:3-1

Codes for Types of Film

Code	Film Type
	Color Film
01	Kodacclor
02	Ektacolor, Type S
03	Ektacolor, Type L
04	Polaroid, color
	Chrome Film
21	Ektachrome, Daylight Type (Process E-3)
22	Ektachrome, Type B (Process E-3)
23	Ektachrome, Daylight Type (Process E-2)
24	Ektachrome, Type F (Process E-2)
25	High Speed Ektachrome, Daylight Type
26	High Speed Ektachrome, Type B
27	Kodachrome, Daylight Type
28	Kodachrome II, Daylight Type
29	Kodachrome II, Professional Type A
	Black & White Film
41	Verichrome Pan
42	Plus-X Pan
43	Plus-X Pan Professional
44	Plus-X Pontrart
45	Panatomic-X
46	Tri-X Pan
47	Tri-X Pan Professional
48	Royal-X Pan
49	High C[illegible]trast Copy
50	Fine Grain Positive
51	Direct Positive Pan
52	Royal Pan (ESTAR Thick Base)
53	Plus-X Pan (ESTAR Thick Base)
54	RS Pan (ESTAR Thick Base)
55	Tri-X Pan (ESTAR Base)
56	Tri-X Pan (ESTAR Thick Base)
57	LS Pan (ESTAR Base)
58	LS Pan (ESTAR Thick Base)
59	Polaroid, B & W
	Infrared Film
71	Ektachrome IR Aero
72	Infrared (Black & White)
73	High Speed Infrared (Black & White)

SITE PHOTOGRAPHS

COUNTRY	SITE NUMBER	SAMPLE NUMBER	FACTOR FAMILY	DATA FORM REFERENCE	DATA GROUP REFERENCE	FILM TYPE	ROLL NUMBER	EXPOSURE NUMBER	LINE NUMBER	STEREOPAIR COMPANION	LENS FOCAL LENGTH	INTEROCULAR DISTANCE	TIME	DAY	MONTH	YEAR	LOCATION AZIMUTH	LOCATION DISTANCE	CAMERA
1 2 3	4 5 6 7	8 9	10	11 12	13 14	15 16	17 18	19 20	21 22	23 24	25 26 27	28 29 30	31 32 33 34	35 36	37 38	39 40	41 42 43	44 45 46 47	48 49
141	0119	01	4	10	03	41	01	01	01	02	050	020	1410	23	04	68	138	0900	3C
141	0119	01	4	10	03	41	01	02	02	01	050	020	1411	23	04	68	138	0900	3C
141	0119	01	4	10	03	28	01	01	03	00	050	000	1430	23	04	68	217	0938	03
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NES FORM NO. 669
REV JAN 1968

F:3-1. Site photographs data forr

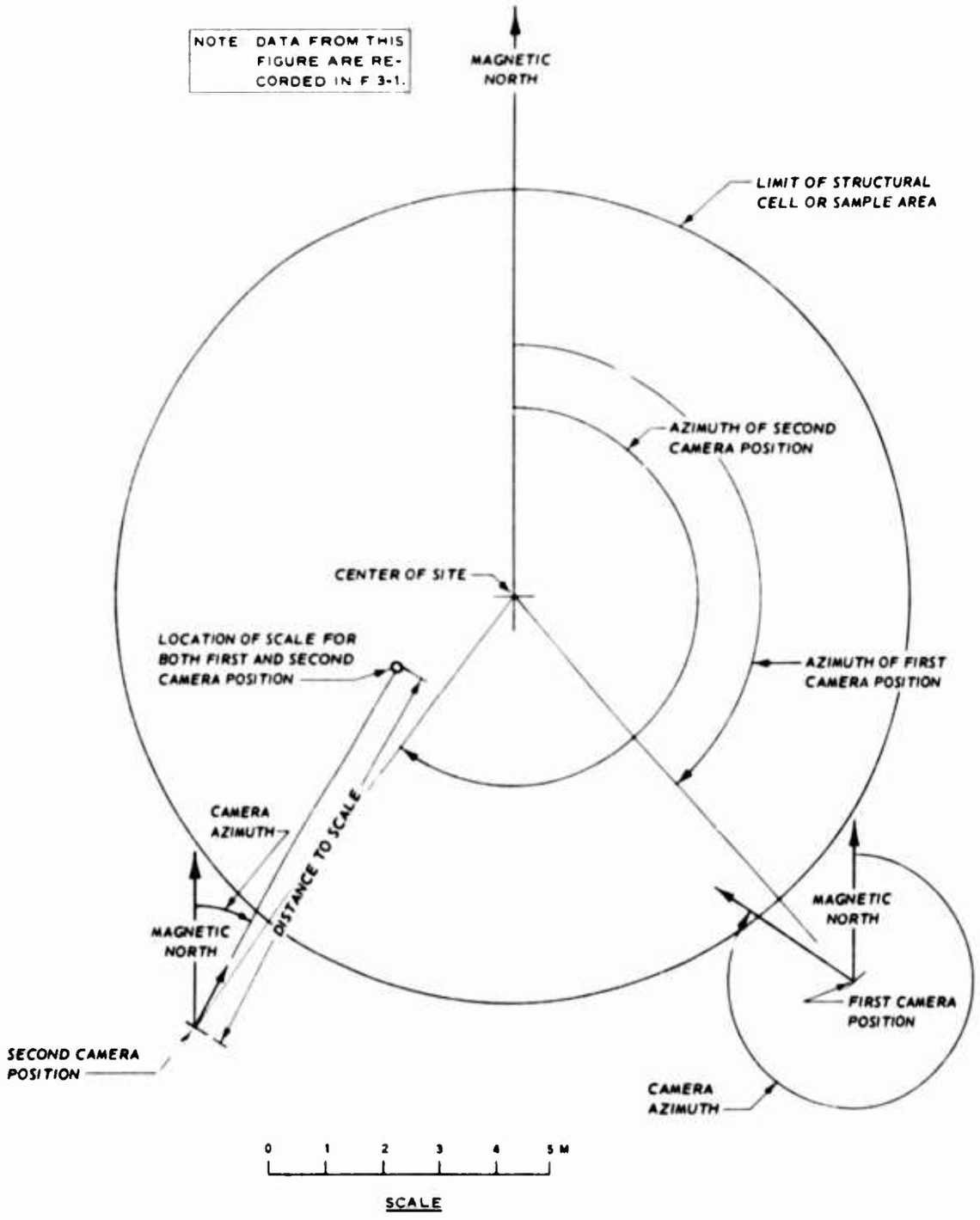
A

SITE PHOTOGRAPHS

TIME	DAY	MONTH	YEAR	LOCATION AZIMUTH	LOCATION DISTANCE	CAMERA AZIMUTH	DISTANCE TO SCALE	TRIPOD	PURPOSE	TOTAL NUMBER OF PHOTOS	COMMENT
2 33 34	35 36	37 38	39 40	41 42 43	44 45 46 47	48 49 50	51 52 53 54	55	56	57 58	59
1 1 0	2 3	0 4	6 8	1 3 8	0 9 0 0	3 0 4	1 0 0 0	1	0	0 3	1
1 1 1	2 3	0 4	6 8	1 3 8	0 9 0 0	3 0 4	1 0 0 0	1	0	0 3	0
1 3 0	2 3	0 4	6 8	2 1 7	0 9 3 8	0 3 0	0 7 3 0	0	1	0 3	1

F:3-1. Site photographs data form

B



F:3-2. Suggested camera locations

a. Stereo frame mounted on camera tripod

b. Crown Graphic camera mounted on stereo frame

F:3-3. Equipment for taking stereophotography

Instruction Module 4

VEGETATION STRUCTURE

A. The purpose of this module is to give detailed instructions for making the measurements necessary to obtain a quantitative description of the three-dimensional geometry of vegetation assemblages, and recording the values thus obtained.

Vegetation Structure: Stem Data [F:4-1]

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B. After selection of the site, proceed according to the following sequence:

1. Country (1-3) {T:1-1} |code|: Select the assigned code number from the table. For example, the United States is 141. Copy this number into all lines used for a site.
2. Site number (4-7) |count|: Within a given country, sites are numbered consecutively from 0001 to 9999. Record the number next in sequence after the last site number that was used. Copy this number into all lines used for a site.
3. Sample number (8-9) |count|: Indicate the number of times the site has been described. Place 01 in this field on the first visit, 02 on the second, and so on. Copy this number into all lines used for a site.
4. Factor family (10) {T:1-2} |code|: The factor family code number is preprinted on the data form.
5. Data form reference (11-12) |code|: The data form reference is preprinted on the data form.
6. Data group reference (13-14) |code|: The data group reference is preprinted on the data form.

NOTE ON ESTABLISHMENT OF STRUCTURAL CELL: Depending upon the nature of the vegetation assemblage, either a structural cell or a sample area can be established. If the assemblage exhibits a relatively uniform distribution of components characterized by an acceptable determinant, use the structural cell as the basis of the area to be described. A convenient rule

of thumb to estimate uniformity of distribution is to note whether there is a detectable tendency of the determinants to occur in clusters of three or more components. If such clustering is noted, use the centers of the clusters as if they were the locations of individual components; in such an event, the structural cell must include at least 20 such clusters. If such clustering is not noted, the individual components characterized by the selected determinant can be used. In most cases, the primary structural cell will be established first, but it is a common and recommended practice to actually describe the smallest secondary cell (if any) first, progressing sequentially from small to large. This practice makes it much more likely that the small plants of the assemblage will be properly described, since they are thus examined before being trampled (as they almost always are to some extent) by the field team in the course of describing the larger plants. To establish the structural cell, the following routine is recommended.

a. After selection of the determinant, determine the radius of a circle required to enclose at least eight members. Referring to F:4-2, locate the number of individuals in the preliminary circle along the horizontal scale, and extend a vertical line to the diagonal line identified as representing the radius of the preliminary circle. In the example, it has been assumed that the radius of the preliminary circle enclosing eight members is 10 m. Carry the intercept horizontally to the scale at the left, and read the probable diameter of the structural cell. In the example, this value is 31 m.

b. Project the circle estimated in paragraph B above into the surrounding assemblage (that is, using the previously established center of the site as an origin, swing an arc with the radius specified in F:4-2 through the surrounding vegetation), and check to ensure that it encloses at least 20 determinants. If 20 members are not included, expand the circle until 20 members are enclosed.

c. This procedure is repeated for each structural cell that is established.

NOTE ON ESTABLISHMENT OF A SAMPLE AREA: If for any reason it is impractical or unsuitable to establish a structural cell, but a description of the

vegetation at a particular place is nevertheless desired, an arbitrary circular sample area is determined. Such an event might arise if, for example, the plants are arranged in strongly linear patterns. The selection of the size of the sample area is completely arbitrary, and the responsibility for determining it rests with the field team. It should be noted that if there is no structural cell, there will be no determinants.

NOTE CONCERNING DEFINITIONS: Basic definitions used in the following instructions are presented in F:4-3 through F:4-21. The figure in which the term is defined is always indicated in brackets behind the column number designations in the items.

7. Components in site (15-17) |count|: Determine the total number of components in the site, and record the value in this field. Obviously this field cannot be filled until the site is completely described. After the site has been completely described, find the highest value in the "Component Number" field (columns 18-20) and record it in the 15-17 field in all lines.
8. Component number (18-20) |count|: Each component that is described must be assigned a number in the order in which it is selected in the field. Place 001 in this field for the first plant selected for description, 002 for the second, etc. If more than one line is used for the description of stem data for a component, repeat the component number for all of the lines used for the component.
9. Line number (21-22) |count|: A full description of a component may require one or more lines. If only one line is required, enter 01 in this field; if more than one line is required, number the lines sequentially. The numbering must be continuous only within one data group.
10. Lines per component (23-24) |count|: This field is left open until the stem data (i.e., data recorded in this data group) for a component have been completely recorded. One or more lines may be required. Determine the last number

in the "Line Number" field (columns 21-22) devoted to each component, and record that number in each line in the 23-24 field. For example, if a component requires 3 lines, record 03 in this field in all three lines devoted to the component.

11. Cell number (25) [F:4-4] |count|: Record the order number (see explanation below) of the structural cell of which the component is a part. All components exhibiting the determinant that was chosen as the basis for a structural cell are identified by the same number in this field. For components comprising the primary structural cell, record 1 in this field; 2 for the smallest secondary cell, 3 for the next largest, etc. If a structural cell was not established, enter 0 in this field.

12. Determinant data group (26-27) [F:4-1] |code|: The determinant that has been chosen as the basis for any structural cell will be some factor recorded in one of three data groups: 04, 05, or 06 (see Data Group Reference field). Note that all three groups are recorded on the same form. Determine the data group reference (columns 13-14) of the factor chosen as the determinant, and record that number in this field. For example, assume that a specific height class of components was chosen as the determinant; the factor "height of component" is recorded in data group 04; therefore, 04 would be recorded in this field. If a class of leaf length had been chosen as the determinant, then 05 would be recorded in this field, since "leaf length" is recorded in data group 05. Record this code only in the first line devoted to a component; if more than one line is used for a component, place 00 in this field in the second and all subsequent lines.

13. Determinant field (28-29) |code|: Record the number of the first column of the field describing the factor selected as the determinant. For example, if a height class

is chosen as the determinant, record the number of the first column of the "height of component" field, i.e., 33. Place the number only in the first line devoted to a component; if more than one line is used for a component, place 00 in this field in the second and all subsequent lines. If the determinant is a combination of two or more factors, place 00 in this field, and a 1 in the "Comment" field (column 80), and describe the determinant on the "Comments" data form (see Instruction Module 6).

14. Height of instrument (30-32) [F:4-3, F:4-8] |cm|: Normally a small site-marker transit or an equivalent instrument for measuring horizontal angles is placed over the center of the site. Measure the vertical distance from the optical axis of the instrument at the center of the structural cell or sample area to the ground surface at that point, and record the value in this field. If more than one line is used for a component, copy this value into all lines devoted to the component. In effect, this means that the height of instrument will be recorded in all lines used for a site.

NOTE CONCERNING HEIGHT OF COMPONENT: If a component has more than one stem (see items 21-23 below), a height must be obtained for that part of the plant resulting from each stem. For example, if there are two stems, two lines will be required; the first line will be used to record the height of the part of the component developed from the larger stem, and the second line will be used to record the height of the crown (or stalk, or whatever) developed from the smaller stem.

15. Height of component (33-36) [F:4-3, F:4-5, F:4-6] |cm|: Record the vertical distance from the basal plane (a horizontal plane passed through the intercept of the component axis and the ground surface) to the highest point of the component. Plants less than about 4 m tall can be measured directly with a Philadelphia rod. Heights of plants more than 4 m tall must be estimated. A convenient method

for measuring component height involves using triangulation principles, as illustrated in F:4-5. If there is more than one stem, be sure to record a height of component for each stem.

16. Attachment (37) [F:4-6] |code|: If the base of the plant can be identified, place a 1 in this field. If not, place a 0 in this field. In the latter case, which is common with vines and lianas, the lowest point in space at which the plant becomes recognizable is arbitrarily assigned as the base of the plant, and the basal intercept is located at that point in space.

17. Distance from cell center (38-41) [F:4-7] |cm|: Record the horizontal distance from the site center to the basal intercept (the intercept of the basal plane and the component axis) in this field.

18. Azimuth (42-44) [F:4-7] |degrees|: Stand at the site center; measure the horizontal angle clockwise from magnetic north to the basal intercept, and record the value in this field. Magnetic north is recorded as 360°, not 0°.

19. Elevation of base (45-48) [F:4-8] |cm|: This item is the result of procedures used to define the elevation of the base relative to the height of the instrument. Sight the instrument along a horizontal line of sight toward the component that is being described. Place a Philadelphia rod beside the component, with the base of the rod at about the same elevation as the basal plane. Read the rod, and record the value in this field. Place a "-" in column 45 if the basal plane is below instrument level, and a "+" in column 45 if the basal plane is above instrument level (HI). If the basal plane is above the instrument level, a convenient method for determining elevation of base is to place a Philadelphia rod at the point where the instrument line of sight intersects the ground surface. Then, with a hand level, stand beside the component and read the rod.

Measure the height above ground of the hand level. Then:

(rod reading) - (height of hand level)
= (elevation of base)

Be sure to place a "+" in column 45 if this procedure is used.. If the component is an air plant (e.g., plants growing on other plants, such as many orchids, mistletoe, etc.) or a liana whose base cannot be identified, it may be necessary to establish the elevation of the base by triangulation. In this event, the same basic procedure as that used to obtain the height of a component may be used.

20. Number of bases (49-50) [F:4-9] |count|: A base is a stem, or part of a stem, that supports the plant and that contacts the surface on which the plant is growing. The surface may be the ground, another plant, or any other surface supporting the plant. Count the number of supporting bases, and record the number in this field.

21. Base diameter (51-53) [F:4-9, F:4-10] |cm|: Measure the diameter of the stem at a point as close to the basal plane as possible. If the stem is simple, this can be done directly with a diameter tape. If, however, the stem is buttressed (that is, if it has a star-shaped, rayed, or amoeboid cross section), measure the length of all of the rays (the length is the straight-line distance from the basal intercept to the point where the buttress extends less than 10 cm above the ground surface), and calculate the average. Multiply the calculated average by 2, and record the product in this field. If there is more than one base (i.e., if the number placed in columns 49-50 is $\geq$02), measure the diameter of each base, and record the values on successive lines in this field. Thus, if there are five stem bases (as for a banyan or mangrove, for example), five lines will be required to record the data.

If there is more than one base, be certain that the component number (columns 18-20) is correctly entered on each line, and that the line numbers (columns 21-22) are recorded in proper sequence. For example, if there are five bases, the numbers 01 through 05 will be entered in the "Line Number" field.

NOTE CONCERNING VERY SMALL COMPONENTS: The stem diameter of components less than 10 cm high is measured only at the basal plane; therefore, the middle and upper diameters are not applicable (NA, in T:4-1). For such components, enter 000 in both the "Middle Stem Diameter" (columns 54-56) and "Upper Stem Diameter" (columns 57-59) fields.

NOTE CONCERNING MULTIPLE STEMS: If there is more than one stem, either because of multiple stems (as described in item 20) or because of a furcation in the stem below the height at which the middle stem diameter is measured, record in the 51-53 field the diameters of all stems passing through the "middle stem diameter" height as specified in T:4-1. For multiple stems resulting from stem furcation (i.e., when a stem divides upward into two or more parts), to be recored as stems, the smallest must be at least one-half the diameter of the largest; smaller furcations are defined as branches, and their characteristics are located in data group 05 (see below). Note that the decision of stems versus branches must also be made at the upper stem diameter level (see item 41). For furcations directed downward, but which pass through the middle stem diameter plane, record only those that are attached to the material supporting the plant. If they terminate in the air, they are considered to be branches, and their properties are recorded in data group 05.

22. Middle stem diameter (54-56) [F:4-9, F:4-10] {T:4-1} |cm|: Measure the diameter of the stem (or stems) at the height above the basal plane as specified in the table.

23. Upper stem diameter (57-59) [F:4-9, F:4-10] |cm|: Measure the diameter of each stem that passes through a horizontal plane at the height specified in T:4-1. Follow the instructions given in item 22.

24. Height of first stem furcation (60-62) [F:4-9, F:4-10]

|cm|: Measure the verticle distance from the basal plane to the height at which the stem first furcates, and record the value in this field. In a plant with stilt roots (for example, a mangrove), the first stem furcation is the point of departure from the main stem of the uppermost stilt root; in a plant having only a single stem at the basal plane, the first stem furcation is the height at which the stem forks into two or more upward-directed parts. If the first stem furcation is above the point at which the upper stem diameter is measured (see T:4-1), place 000 in this field. All furcations above the upper stem diameter are considered to be branches.

25. Number of buttresses (63-64) [F:4-10] |count|: If the stem of the component has a star-shaped or rayed cross section at or slightly above the basal plane, count the number of rays and record the value in this field. If the stem is not buttressed, place 00 in this field.

26. Component axis to most distant base (65-68) [F:4-9, F:4-10] |cm|: Measure the horizontal distance from the basal intercept to the center of the most distant independent base (assuming the component has multiple bases), or to the tip of the longest buttress (if the component exhibits stem buttresses), and record the value in this field. If the stem is neigher multiple nor buttressed, place 00 in this field.

27. Attitude (69-71) [F:4-11] |cm|: Measure the horizontal distance from the basal intercept to the intercept in the basal plane of a vertical line dropped from the component axis at the point specified for measuring the upper stem diameter (see T:4-1), and record the value in this field.

28. Sinuosity (72-74) [F:4-11] |cm|: Measure the length of the component axis from the basal plane to the point at which the upper stem diameter (see T:4-1) is measured, and record the value in this field. Make certain to follow all of the curves; sinuosity is not a straight-line distance

unless, of course, the stem is perfectly straight.

29. Hardness (75) |mm|: Measure the depth to which a standard wooden pencil (approximate diameter 7 mm) sharpened to a conical point about 25 mm long, can be driven by hand into the component stem after removal of the bark (if any), and record the value in this field. Record any penetration depth of greater than 9 mm as 9; if appropriate, place a 1 in column 80, and record the actual depth of penetration on the "Comments" data form (Instruction Module 6).

30. Length of stem spines (76-77) |mm|: Measure the approximate average length of any hard, sharp protrusion capable of inflicting a wound on unprotected human flesh, and enter the value in this field. If there are no such protrusions, place 00 in this field.

31. Irritants (78) |code|: If there are irritating hairs or any other type of irritant on the stem, place a 1 in this field; if there are none, record 0.

32. Nomenclature (79) |code|: If taxonomic or other data relating to plant identification are obtained for the component, place 1 in this field; this indicates the existence of a "Vegetation Nomenclature" card (data group 07, see Instruction Module 5). Be certain to write out the vegetation nomenclature data on the appropriate form immediately. If nomenclature information is not obtained, place 0 in this field.

33. Comment (80) |code|: On the first line devoted to a site, place a 1 in this field. On the "Comments" data form (Instruction Module 6), record the last name of the leader of the team making the measurements. In addition, if for any reason it seems desirable to record supplementary information, write it out on the "Comments" data form in accordance with the instructions given in Instruction Module 6. If no comments have been made pertinent to this line in this data group, enter 0 in this field.

NOTE CONCERNING PROCEDURE: After all of the stem data (i.e., those data called for in data group 04) for a component have been recorded, proceed immediately to data group 05 (branch and foliage data) and measure and record those data for the component. That is, move through the vegetation assemblage component by component, completely describing one before proceeding to another.

Vegetation Structure: Branch and Foliage Data [F:4-1]

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C. After completion of all stem data (items 1-33), proceed according to the following sequence:

34. Country...Sample number (1-9): Copy all values in the first line of data group 04 into the corresponding columns in this data group.
35. Factor family...Data group reference (10-14): All values in these columns are preprinted on the data form.
36. Components in site (15-17) |count|: Copy the value in this field from that in data group 04 (Stem Data).
37. Component number (18-20) |count|: The data on branches and foliage that are recorded in this data group (05) are continuations of records of components started in data group 04. Thus, in every case there must be at least one line in this data group (i.e., 05) for each component in data group 04. Record the number of the component that is being described.
38. Line number (21-22) |count|: In many cases, a single component will require more than one line for a complete record. Place the numbers consecutively in this field.
39. Lines per component (23-24) |count|: Count the total number of lines required for recording all of the data pertinent to a component in this data group, and record the number in this field. This number must match the highest value for the component that is recorded in the "Line Number" field (columns 21-22). Note that the value refers

only to the number of lines used in this data group (i.e., data group 05).

40. Continuation number (25-26) |code|: Each line in data group 05 is a continuation of a specific line in data group 04. For example, if a component has two stems, two lines will be required in data group 04. The two stems may exhibit different branching and foliage characteristics, which will require at least two lines in this data group (05). In this field, record the line number of the line in data group 04 of which the data being recorded is a continuation.

NOTE CONCERNING BRANCHES: A branch is any structure that exhibits a thickness of more than 5 mm at a distance of 10 cm from the surface of the stem to which it is attached. If a member is less than 5 mm in thickness (see F:4-13 and statement below for definition of thickness), it is a leaf if it is blade-like or needle-like (see F:4-16), or a twig if it is shaped in cross section like a branch (see F:4-13). If it is a twig, it is not included in the description, except indirectly and en mass as a part of the component crown. Branches do not necessarily exhibit round or even oval cross sections; by the definition above, the midrib of a palm frond is a branch, and many such structures have triangular or lunate shapes, as illustrated in F:4-13. Branch dimensions are defined in a special way: branch width is the longest dimension that can be obtained from the cross section. The dimension need not be measured through the figure (see examples 4 and 5 in F:4-13). Branch thickness is the greatest dimension in the cross section that can be measured at right angles to the line defining width; it must pass through the cross-section figure.

41. Branching height (27-30) [F:4-12] |cm|: Measure the vertical distance from the branch intercept plane (a horizontal plane passed through the intercept of the stem axis and the branch axis) to the basal plane, and record the value in this field. If there are no branches (example: many, but not all, sahuaro), record 0000 in this

field. If the branch originates at ground level, enter 0001 in the field. If the furcation is less than the height at which the upper stem diameter (item 23) is measured, the furcation must be less than one-half the diameter of the largest furcation to qualify as a branch; if it is greater than one-half the diameter of the largest furcation, it is defined as a stem.

42. Branch width (31-34) [F:4-13] |mm|: Measure the greatest dimension that can be found in the branch cross section at a distance of 10 cm from the surface of the stem to which it is attached and record the value in this field. Note that the measurement need not be made through the geometric center of the branch cross section.

43. Branch thickness (35-38) [F:4-13] |mm|: Measure the maximum dimension in the cross section at right angles to the line along which branch width was measured, and record the value in this field.

44. Number of edges (39) [F:4-13] |count|: Count the number of edges in the cross section that exhibit acute angles (i.e., angles of 90° or less), and record the number in this field. Rounded edges, as in ribbon lianas, are not considered to be edges.

45. Branch angle (40-42) [F:4-12] |degrees|: Measure the vertical angle between a vertical line dropped from the branch intercept and a straight line projected from the branch intercept through the axis of the branch at the point at which its width (item 42) was measured, and record the value in this field.

46. Branch length (43-46) [F:4-12] |cm|: Measure the horizontal straight-line distance from the branch intercept to the furthest extension of the branch, including its twigs and leaves, if any, and record the value in this field.

47. Branch tip height (47-50) [F:4-12] |cm|: Measure the

vertical distance from the basal plane to the point at the branch tip selected in item 46, and record the value in this field.

48. Azimuth to branch tip (51-53) [F:4-14] |cm|: Measure the azimuth clockwise from magnetic north from the branch intercept to the furthest extension of the branch, including its twigs and leaves, if any, and record the angle in this field. Magnetic north is recorded as 360°, not 0°.

49. Furcation type (54) [F:4-15] |code|: Determine the furcation type by matching most closely with the definitions and diagrams shown in F:4-15, and record the code number in this field. Although the "type examples" are easy to identify, the variations quite naturally grade into each other in complicated ways. Usually the first judgement is the best; if a decision cannot be made, place a 1 in the "Comment" field (column 74), and describe the furcation on a "Comments" data form (Instruction Module 6).

50. Length of branch spines (55-56) |m|: Measure the approximate average length of any spines that appear on the branches or the twigs, and record the value in this field. If there are none, place 00 in the field.

51. Location of branch spines (57) |code|: Determine the location on the branch of the spines (if any), and record the location according to the following code:

Code No.	Location of Spines
0	Spines absent
1	On branch edges only
2	On branch tip only
3	On both branch tip and edge
4	On entire surface

52. Irritants (58) |code|: Determine whether there are any irritating hairs or other irritant structures or chemicals

on the branches. If irritants are found, place 1 in this field; if none are present, place 0 in this field.

NOTE CONCERNING FOLIAGE: For purposes of this description procedure, a "leaf" is any blade-like, sheet-like, or needle-like structure that is less than 5 mm thick. For example, a fern frond is defined as a leaf. Each leaflet of a compound leaf is considered to be an individual leaf. Each leaf segment, separated from its neighbors by a dissection to the midrib, as in many palms, is considered to be a leaf, and in such cases the midrib is regarded as a branch, as discussed in the note concerning branches (above). If the leaf is of the typically blade-like or spatulate form, the term "leaf" applies only to the blade, and not to the shaft (i.e., the petiole). Leaves must be present at the time of inspection in order to be recorded, even if the component is known to have leaves at some other time. Leaf sizes on any one component are normally quite variable. Select a leaf that appears to be mature and of approximately average size, and record the following information concerning it.

53. Leaf length (59-62) [F:4-16] |mm|: Measure the longest dimension, and record the value in this field. Please note that the longest dimension may not be parallel to the midrib. If no leaves are present on the component, place 0000 in this field, and in columns 63-73.

54. Leaf width (63-66) [F:4-16] |mm|: Measure the greatest distance across the leaf at right angles to the line along which leaf length was measured, and record the value in this field.

55. Leaf thickness (67) |mm|: Measure the thickness of the leaf blade, not the large veins, and record the value in this field. Variation is usually significant only in the succulent or fleshy leaves; for these, measure the maximum thickness found in the leaf. If the leaf is very thin and filmy (i.e., less than 0.5 mm thick), enter a 0 in this field, even though leaves are present.

56. Leaf condition (68) |code|: Determine and record the condition of the leaf according to the following code:

Code No.	Condition
0	No leaves present
1	Present and living
2	Dead, but still clinging to component

57. Length of leaf spines (69-70) [F:4-16] |mm|: Determine the approximate average length of any spines on the leaves, and record the value in this field. In cases where there is no obvious differentiation between armature and leaf body (as in many grasses with hardened leaf tips), the length of leaf spines is the distance from the tip to the point where the leaf reaches a width of 2 mm.

58. Location (71) [F:4-16] |code|: Determine the position of the spines on the leaf, and record according to the following tabulation:

Code No.	Location of Spines
0	Spines absent
1	On leaf margin only
2	On leaf tip only
3	On both leaf margin and leaf tip
4	On entire surface

59. Sharp edges (72) |code|: If the leaf has a sharp or cutting edge capable of inflicting a wound on unprotected human flesh, record 1 in this field; if there are no such edges, place a 0 in this field.

60. Irritants (73) |code|: If there are irritants of any type on or in the leaf, place a 1 in this field. If there are none, place a 0 in the field.

61. Comment (74) |code|: If it is necessary or desirable to record a comment relevant to any material recorded in this line, place a 1 in this field, and record the comment on the "Comment" form (Instruction Module 6).

D. After completion of all branch and foliage data (items 34-60) proceed according to the following sequence.

62. Country...Sample number (1-9): Copy all values in the first line of data group 04 into the corresponding columns in this data group.

63. Factor family...Data group reference (10-14): All values in these columns are preprinted on the data form.

64. Components in site (15-17) |count|: Copy the value in this field from that in data group 04 (Stem Data).

65. Component number (18-20) |count|: The data on crowns in this data group (06) are continuations of records of components that were started in data group 04. Thus, in every case there must be at least one line in this data group (i.e., 06) for each component in data group 04. Record the number of the component that is being described.

66. Line number (21-22) |count|: In many cases, a single component will require more than one line for a complete record. Place the numbers consecutively in this field.

67. Lines per component (23-24) |count|: Count the total number of lines required for recording all of the data pertinent to a component in this data group, and record the number in this field. This number must match the highest value for the component that is recorded in the "Line Number" field (columns 21-22). Note that the value refers only to the number of lines used in this data group (i.e., data group 06).

68. Continuation number (25-26) |code|: Each line in data group 06 (the present data group) is a continuation of a specific line in data group 04. For example, if a component has two crowns, two lines will be required in data group 04. The two crowns may exhibit different characteristics, which will require at least two lines in this data

group (06). In this field, record the line number of the line in data group 04 of which the data being recorded is a continuation.

NOTE CONCERNING CROWNS: The crown is the volume encompassing the leaf and twig mass. The following items describe the recording of information relevant to the size and shape of the crown of the component and the location of the crown with respect to the center of the structural cell.

69. Distance to crown center (27-30) [F:4-3, F:4-17] |cm|: Measure the horizontal distance from the center of the structural cell to the geometric center of the figure that would result from projecting the crown of the component vertically to the basal plane, and record the value in this field. If there is no "crown" (as, for example, an unbranched sahuaro), record the horizontal distance to the highest tip of the stem.

70. Azimuth to crown center (31-33) [F:4-17] |degrees|: Measure the horizontal angle between magnetic north and the center of the crown projection, and record the value in this field.

71. Azimuth of primary plane (34-36) [F:4-18] |degrees|: Pass a vertical plane through the crown center in the direction that will result in the largest projected crown area if the surface of the crown were projected to the plane along lines normal to the plane. Measure the azimuth of the plane, and record it in this field.

NOTES CONCERNING PRIMARY GRID: The primary grid is formed by placing a rectangle on the primary plane in such a way that top and bottom of the rectangle barely touch the tip and the lowest part of that part of the crown intercepted by the primary plane, and with the vertical sides of the rectangle just touching the widest projections of the portion of the crown intercepted by the same plane (top sketch, F:4-19). Some judgment is required, especially with respect to identification of the lowest portion of the crown. As a general rule, the crown is the envelope enclosing the leaf and twig mass, even if some portions of that mass no

longer bear leaves; the minor branchlets that commonly sprout along the stems of some plants (such as the American elm) are not usually included as part of the crown. The grid is divided into five vertical zones of equal width, with sequentially numbered lines separating the zones, with 1 being that edge that is either in the northwest or southwest quadrant; and into four horizontal zones of equal width with sequentially lettered lines separating them with (A) at the top. In the field, the process of constructing a primary grid is generally accomplished by making a sketch of the crown, as viewed from a point at right angles to the plane chosen as the primary plane, and then fitting the primary grid to the sketch. Where the components are very large, and the crowns interfingered in a canopy (as in many tropical and temperate forests), a good deal of judgment is required. Substantial errors undoubtedly occur, but the method provides at least a generalized numerical description of crown size and shape.

72. Vertical dimension of primary grid (37-40) [F:4-19] |cm|: Measure the vertical dimension of the primary grid, and enter the value in this field.

73. Horizontal dimension of primary grid (41-44) [F:4-19] |cm|: Measure the horizontal dimension of the primary grid, and record the value in this field.

74. Intercepts on line A (45-46) [F:4-19] |code|: In F:4-19, it can be noted that the trace of the crown passes successively across the vertical (numbered) lines in the grid. Start at the upper left corner (intercept of line 1 and line A), and note the point at which the trace of the crown crosses the vertical lines in relation to line A. In the figure, there is no intercept between lines A and B on line 1. However, the trace of the crown crosses line 2 closer to line A than to line B, and this event is classified as an intercept at line 2 on line A. Place a 2 in column 45. Looking at line 3, find another intercept of the crown trace closer to line A than to line B, but do not record this because the crown trace crosses line 4

closer to line A than to line B. After this, the trace of the crown falls closer to line B. Therefore, place a 4 in column 46, and ignore the fact that the crown trace crosses line 3 close to line A, since a line connecting points 2 and 4 on line A will pass through point 3. If the trace touches only one point on line A (as is often the case), record only the code for the single nearest vertical line, and place it in column 45 of the data form; place a 0 in column 46. If there is no crown, place 0 in both columns.

75. Intercepts on line B (47-48) [F:4-19] |code|: Observe the intercepts on line B and enter them in this field.

76. Intercepts on line C (49-50) [F:4-19] |code|: Observe the intercepts on line C and enter them in this field.

77. Intercepts on line D (51-52) [F:4-19] |code|: Observe the intercepts on line D and enter them in this field.

78. Intercepts on line E (53-54) [F:4-19] |code|: Observe the intercepts on line E and enter them in this field.

NOTES CONCERNING SECONDARY GRID: The secondary grid is formed in the secondary plane in the same manner described for establishing the primary grid on the primary. This secondary plane is passed through the crown normal to the primary plane at a point such that the plane intercepts the highest possible crown area. See top sketch of F:4-20. In the field, the shape of the crown on the secondary grid is sketched, and the grid is fitted to it in the same fashion as for the primary grid.

79. Vertical dimension of the secondary grid (55-58) [F:4-20] |cm|: Measure the vertical dimension of the secondary grid and enter it in this field.

80. Horizontal dimension of the secondary grid (59-62) [F:4-20] |cm|: Measure the horizontal dimension of the secondary grid and enter it in this field.

81. Intercepts on line F (63-64) [F:4-20] |code|: Observe the intercepts on line F and enter them in this field.

82. Intercepts on line G (65-66) [F:4-20] |code|: Observe the intercepts on line G and enter them in this field.

83. Intercepts on line H (67-68) [F:4-20] |code|: Observe the intercepts on line H and enter them in this field.

84. Intercepts on line I (69-70) [F:4-20] |code|: Observe the intercepts on line I and enter them in this field.

85. Intercepts on line J (71-72) [F:4-20] |code|: Observe the intercepts on line J and enter them in this field.

86. Comments (73) |code|: If for any reason a comment is needed for data group 06, place a 1 in this field and record the comment on the "Comments" data form (Instruction Module 6). If no comments are to be made pertinent to this line in this data group, enter 0 in this field.

T:4-1

Height Above Basal Plane of Diameter Measurements

Height of Component	Height Above Basal Plane of Diameter Measurements	
	Middle	Upper
<10 cm	NA*	NA*
10-30 cm	2 cm	4 cm
30-100 cm	10 cm	20 cm
100-200 cm	30 cm	60 cm
200-500 cm	60 cm	120 cm
>500 cm	100 cm	200 cm

* See note concerning very small components in text preceding item 22.

VEGETATION STRU

STEM DATA

1 2 3	4 5 6 7	8 9	10	11 12	13 14	15 16 17	18 19 20	21 22	23 24	25 26 27	28 29	30 31 32	33 34	35 36	37	38 39	40 41	42
COUNTRY	SITE NUMBER	SAMPLE NUMBER	FACTOR FAMILY	DATA FORM REFERENCE	DATA GROUP REFERENCE	COMPONENTS IN SITE	COMPONENT NUMBER	LINE NUMBER	LINES PER COMPONENT	CELL NUMBER	DETERMINANT DATA GROUP	DETERMINANT FIELD	HEIGHT OF INSTRUMENT	HEIGHT OF COMPONENT	ATTACHMENT	DISTANCE FROM CELL CENTER		
			4	1 0	0 4													
			4	1 0	0 4													
			4	1 0	0 4													
			4	1 0	0 4													
			4	1 0	0 4													

BRANCH AND FOLIAGE DATA

1 2 3	4 5 6 7	8 9	10	11 12	13 14	15 16 17	18 19 20	21 22	23 24	25 26	27 28 29 30	31 32 33 34	35 36	37 38	39 40	41 42	4
COUNTRY	SITE NUMBER	SAMPLE NUMBER	FACTOR FAMILY	DATA FORM REFERENCE	DATA GROUP REFERENCE	COMPONENTS IN SITE	COMPONENT NUMBER	LINE NUMBER	LINES PER COMPONENT	CONTINUATION NUMBER	BRANCHING HEIGHT	BRANCH WIDTH	BRANCH THICKNESS	NUMBER OF EDGES	BRANCH ANGLE		
			4	1 0	0 5												
			4	1 0	0 5												
			4	1 0	0 5												
			4	1 0	0 5												
			4	1 0	0 5												

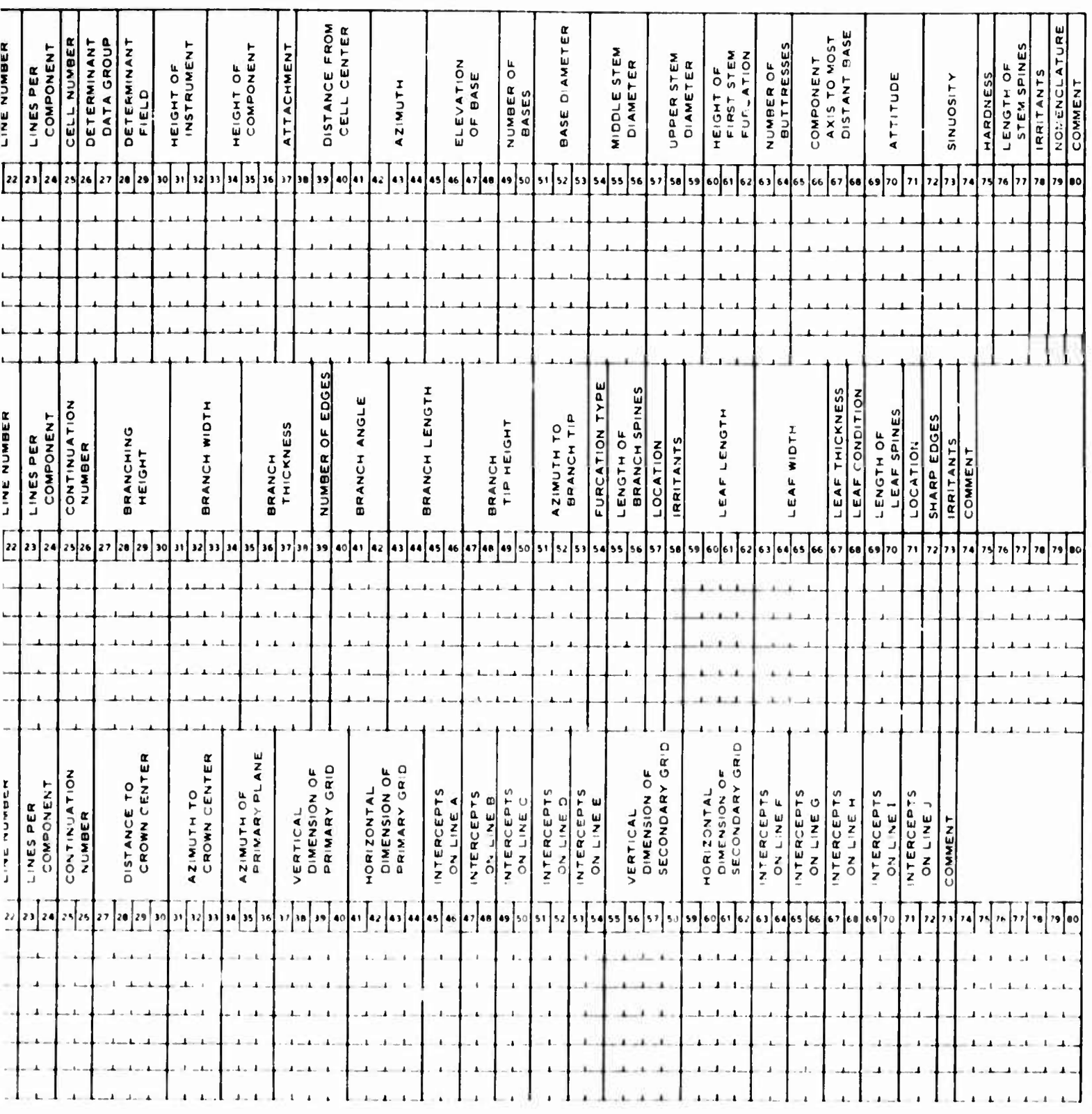
CROWN DATA

1 2 3	4 5 6 7	8 9	10	11 12	13 14	15 16 17	18 19 20	21 22	23 24	25 26	27 28 29 30	31 32 33	34 35 36	37 38 39	40	41 42	4
COUNTRY	SITE NUMBER	SAMPLE NUMBER	FACTOR FAMILY	DATA FORM REFERENCE	DATA GROUP REFERENCE	COMPONENTS IN SITE	COMPONENT NUMBER	LINE NUMBER	LINES PER COMPONENT	CONTINUATION NUMBER	DISTANCE TO CROWN CENTER	AZIMUTH TO CROWN CENTER	AZIMUTH OF PRIMARY PLANE	VERTICAL DIMENSION OF PRIMARY GRID		HORIZONTAL DIMENSION OF	
			4	1 0	0 6												
			4	1 0	0 6												
			4	1 0	0 6												
			4	1 0	0 6												
			4	1 0	0 6												

WES FORM NO.
REV JAN 1968 1666

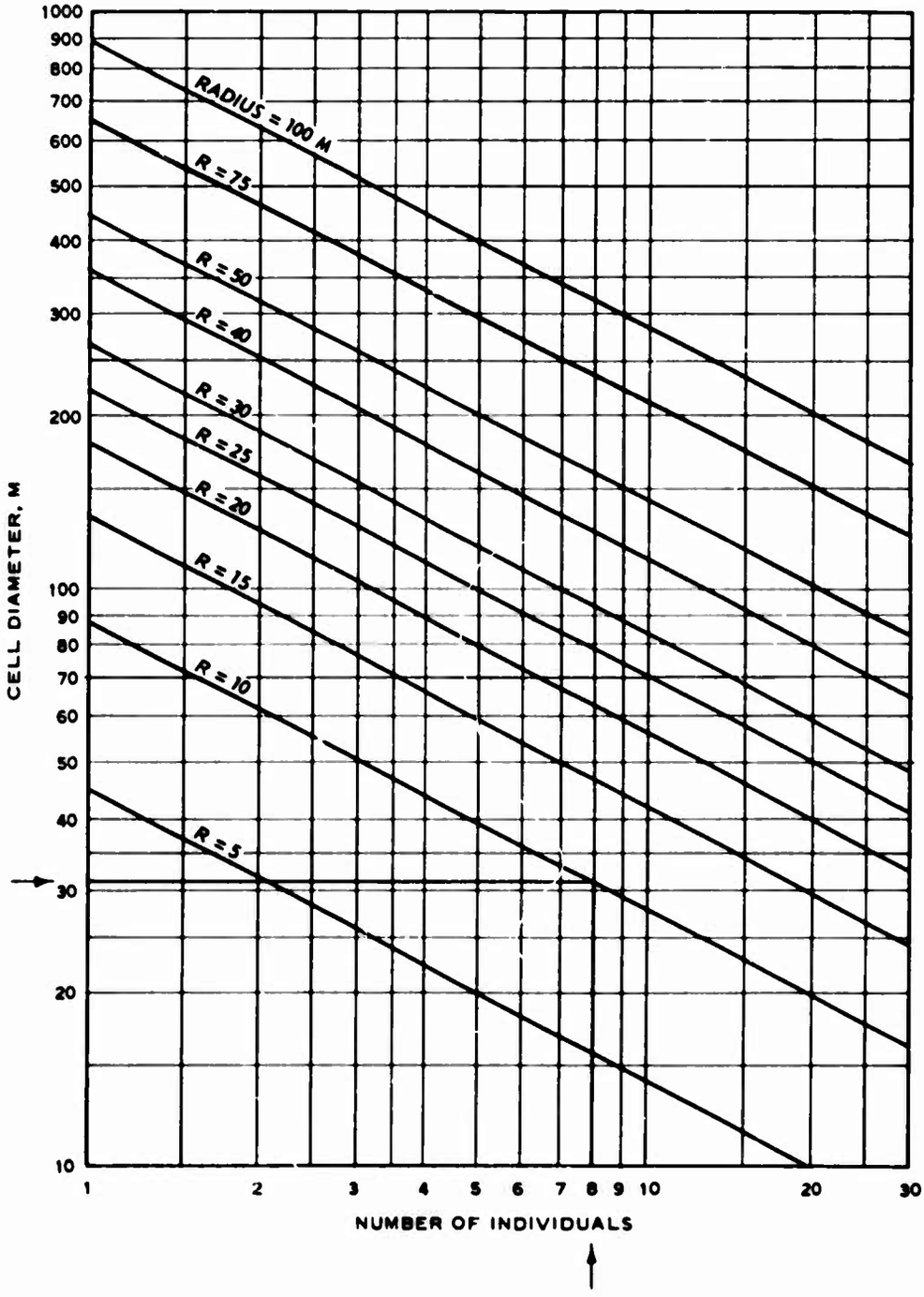
F:4-1. Vegetation struct

A

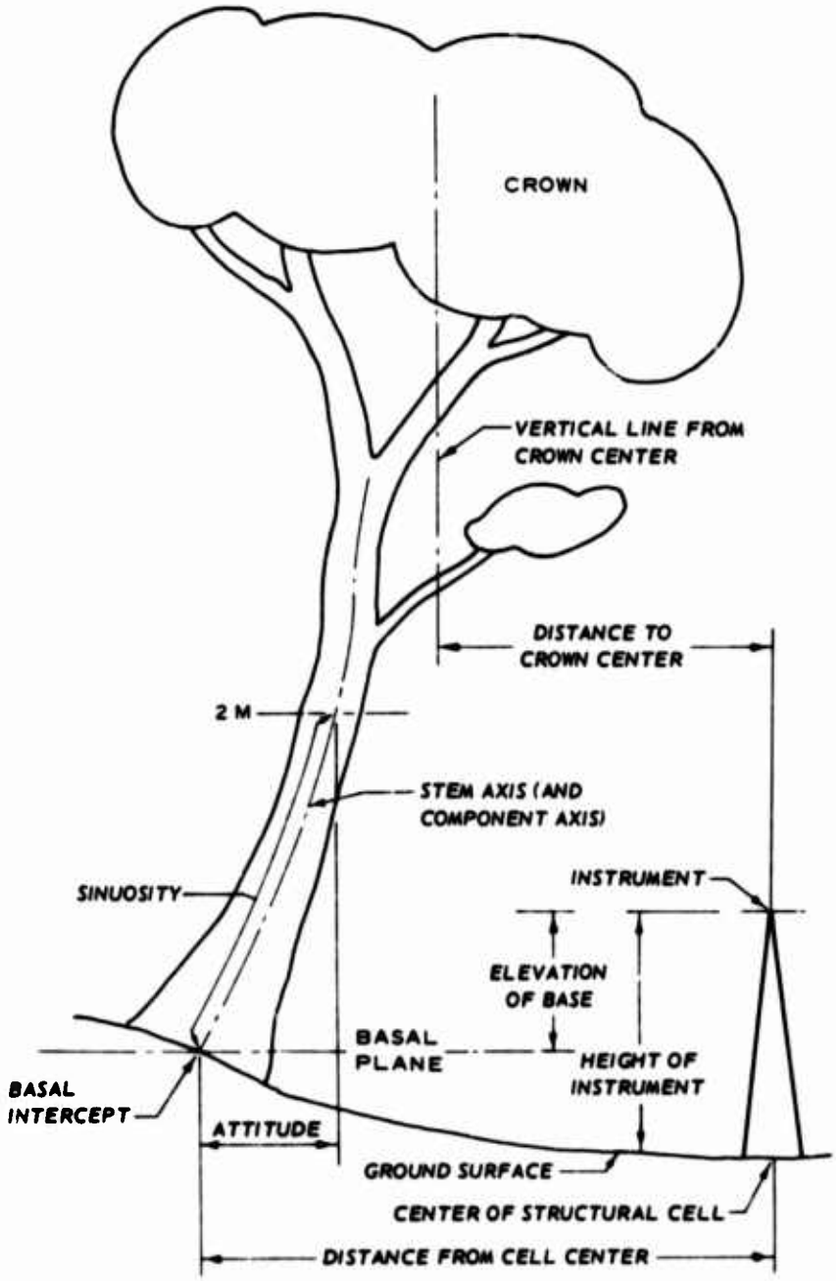


F:4-1. Vegetation structure data form

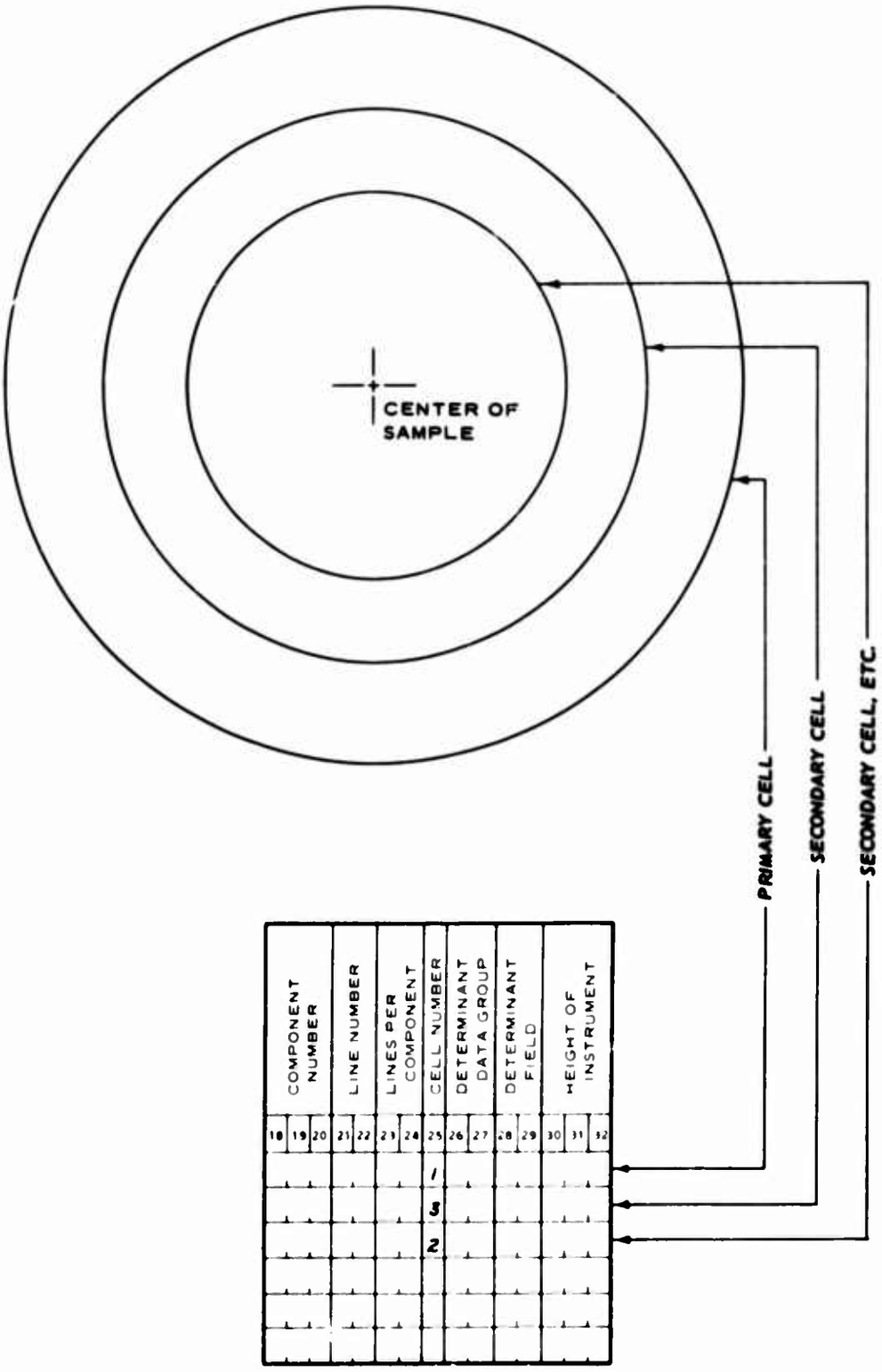
B



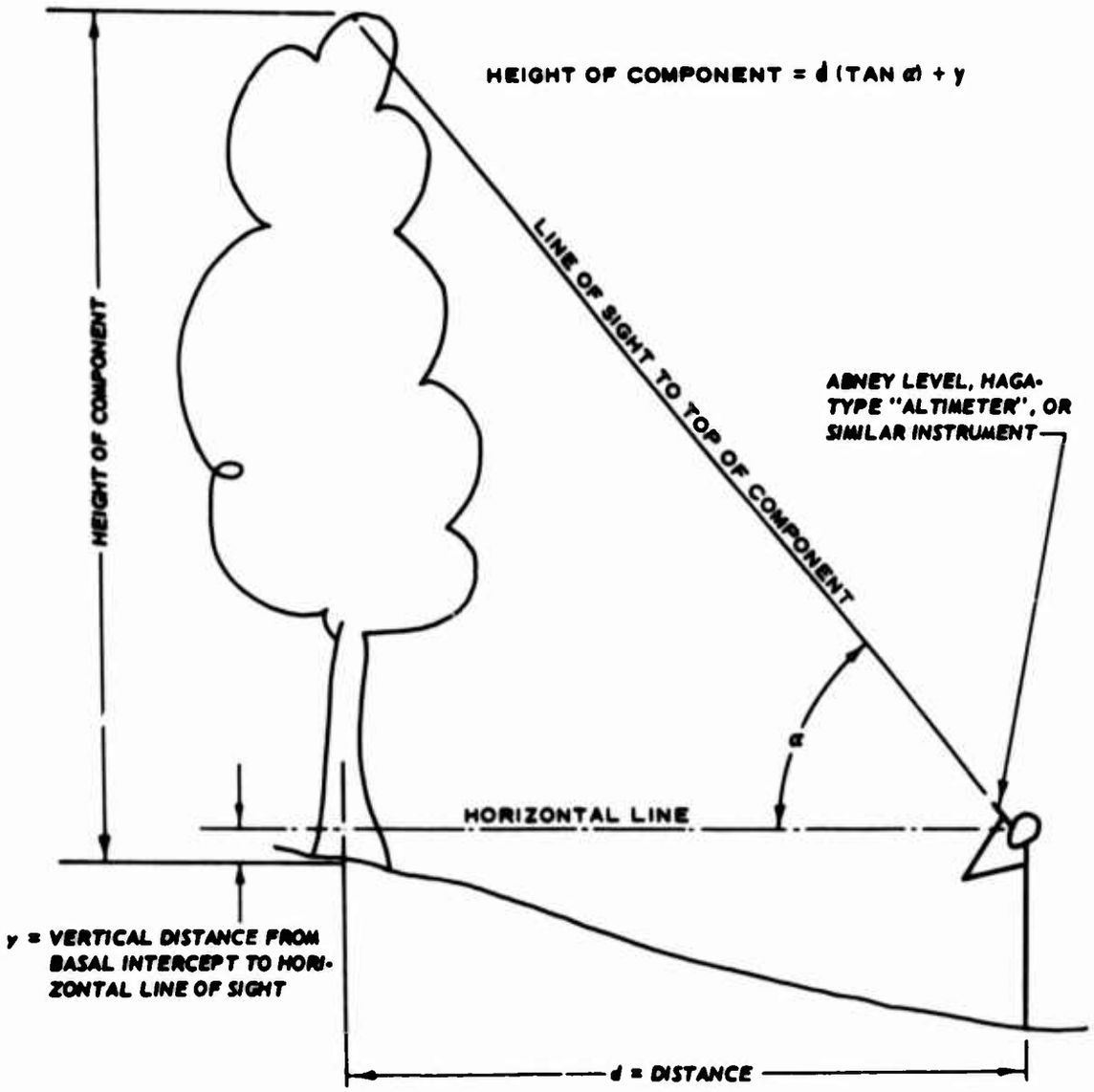
F:4-2. Prediction of minimum cell diameter from number of individuals



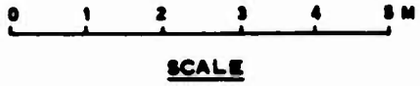
F:4-3. Basic definitions



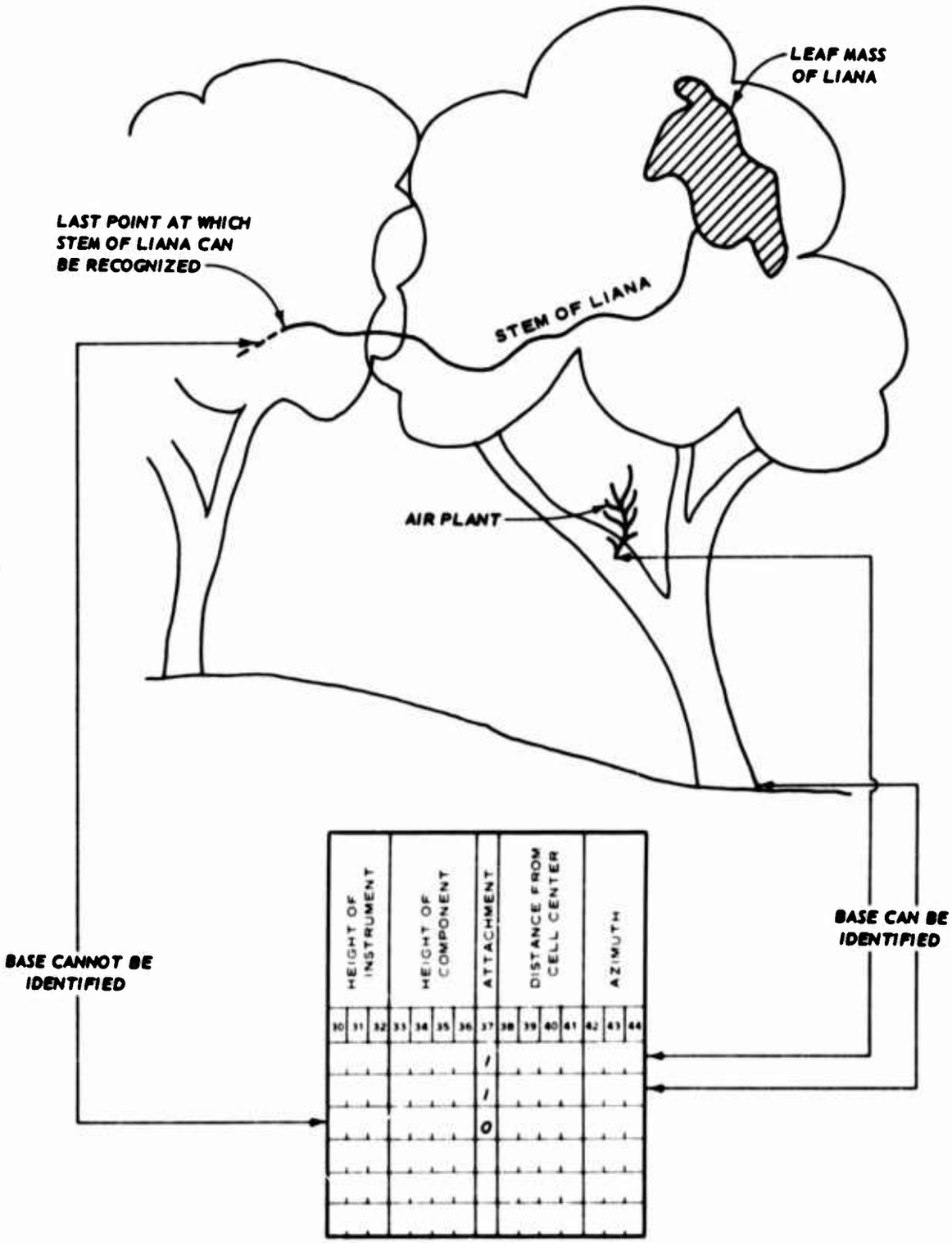
F:4-4. Notation of cell numbers



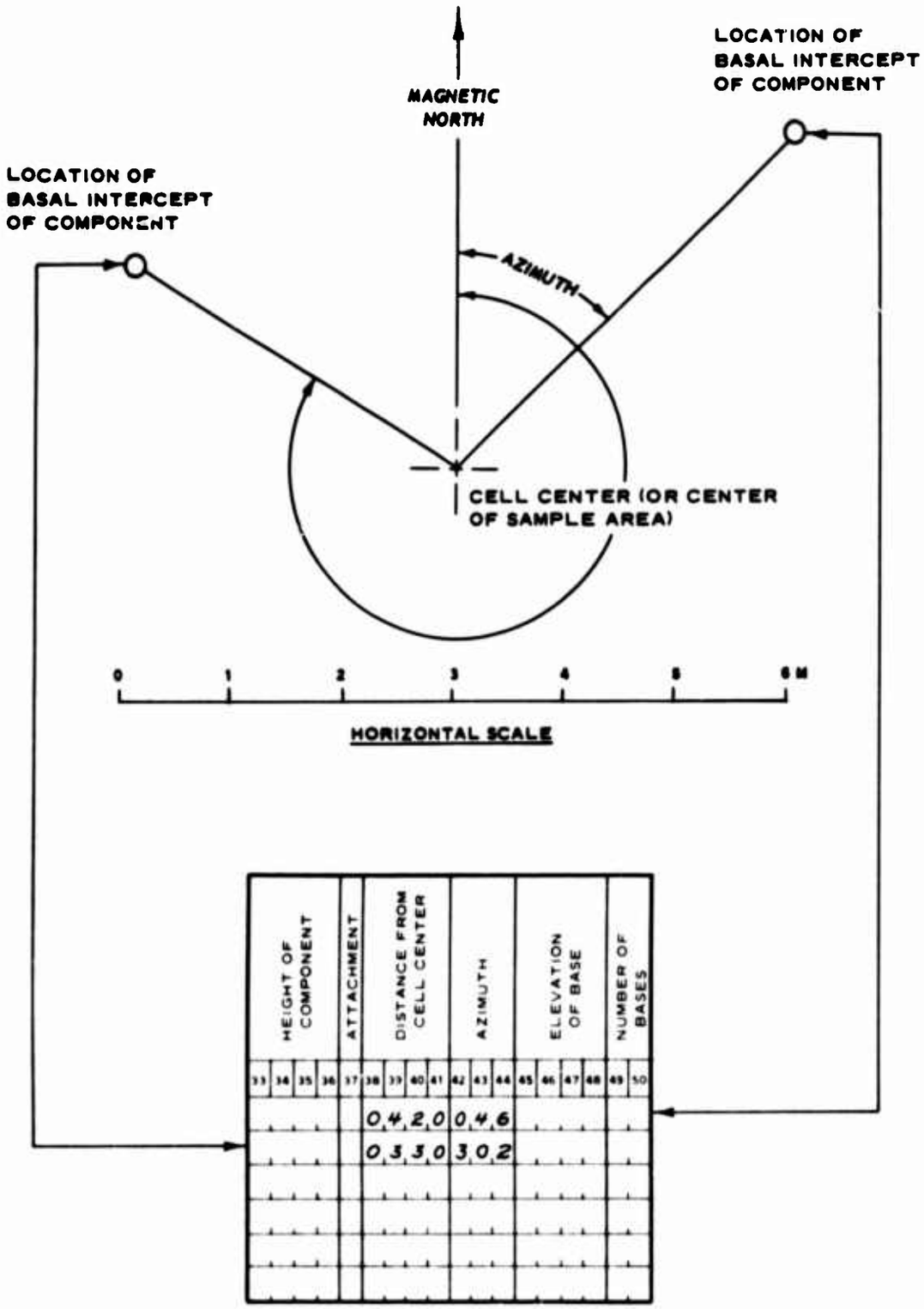
DETERMINANT DATA GROUP	DETERMINANT FIELD	HEIGHT OF INSTRUMENT	HEIGHT OF COMPONENT	ATTACHMENT	DISTANCE FROM CELL CENTER
26 27	28 29	30 31 32	33 34 35 36	37	38 39 40 41
			1 1 3 6		



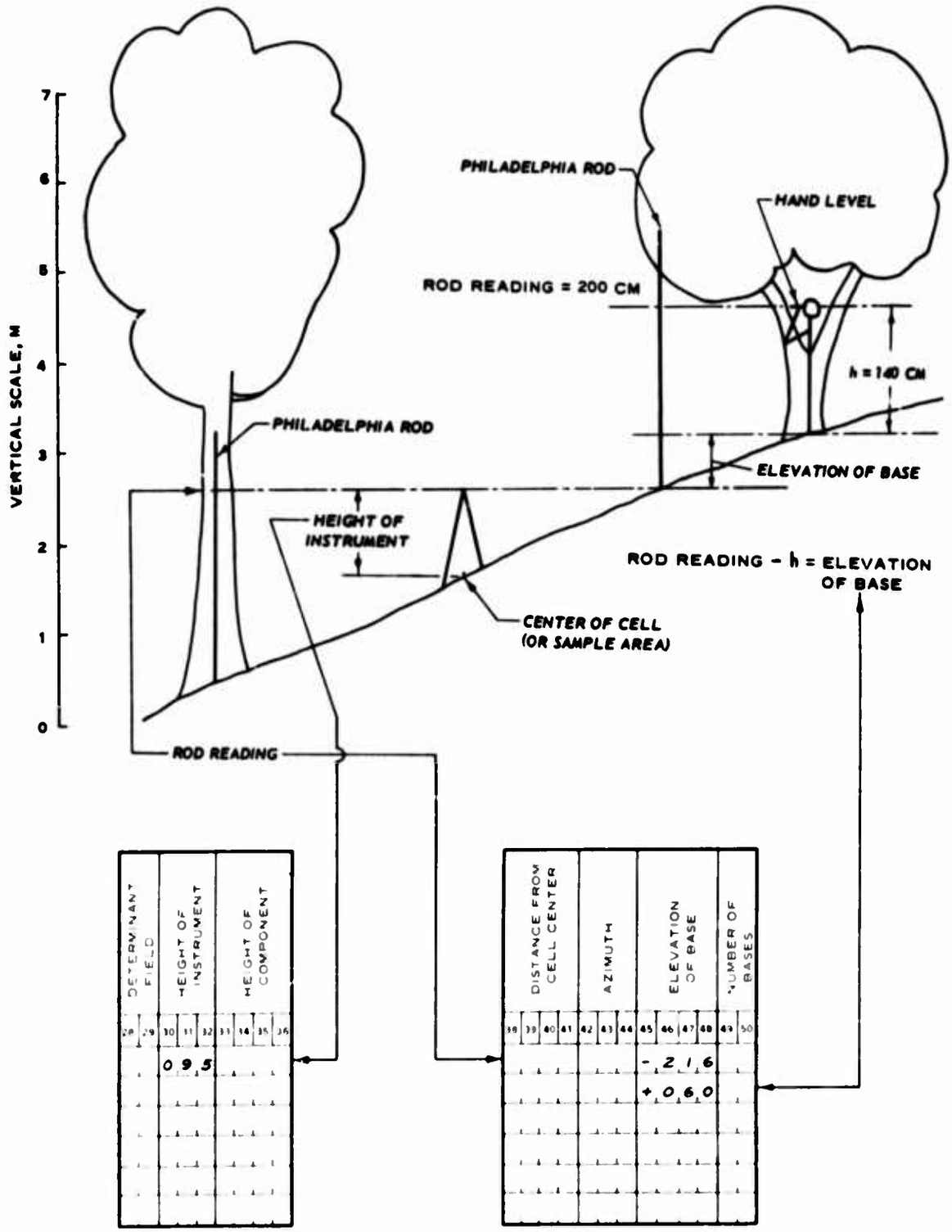
F:4-5. Measurement of plant height by triangulation



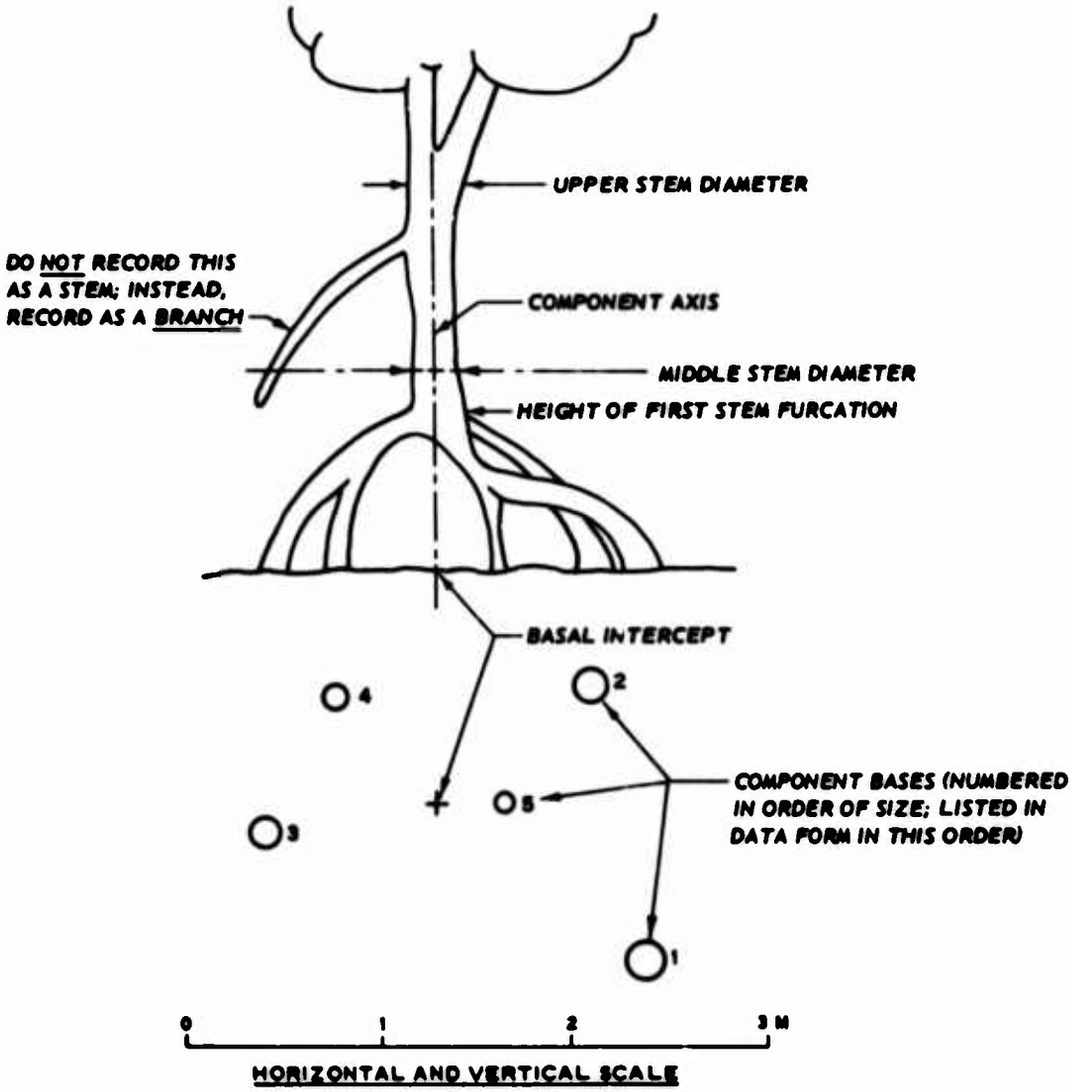
F:4-6. Example of notation for component attachments



F:4-7. Notation of distance from cell center and azimuth

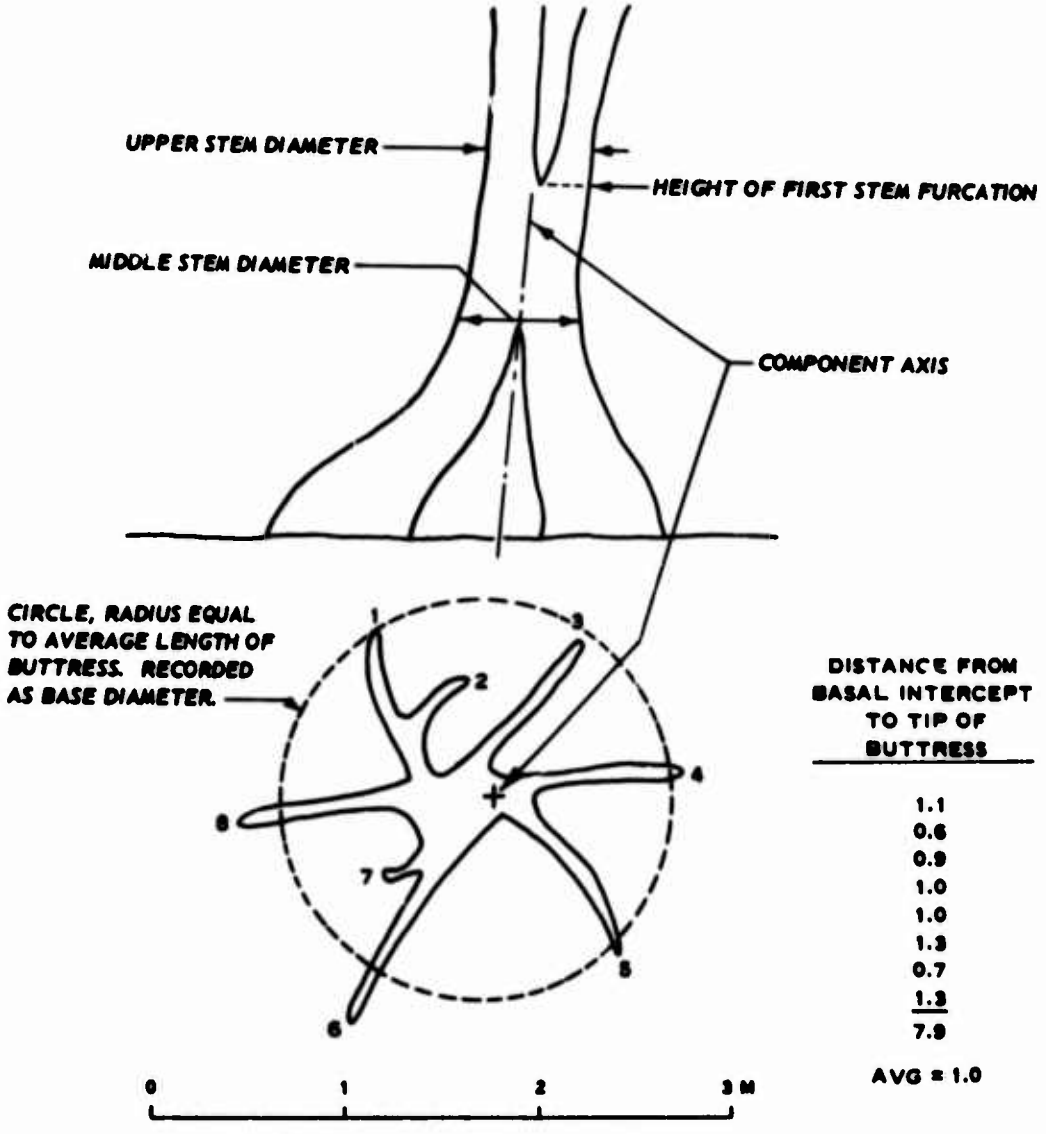


F:4-8. Recording of elevation of base



ELEVATION OF BASE	NUMBER OF BASES	BASE DIAMETER	MIDDLE STEM DIAMETER	UPPER STEM DIAMETER	HEIGHT OF FIRST STEM FURCATION	NUMBER OF BUTTRESSES	COMPONENT AXIS TO MOST DISTANT BASE	ATTITUDE
45 46 47 48	49 50	51 52 53	54 55 56	57 58 59	60 61 62	63 64	65 66 67 68	69 70 71
	05	019	029	040	085	00	0135	
	05	017	000	000	000	00	0000	
	05	014	000	000	000	00	0000	
	05	012	000	000	000	00	0000	
	05	009	000	000	000	00	0000	

F:4-9. Notation of data concerning variations in structure of bases (stilt roots)

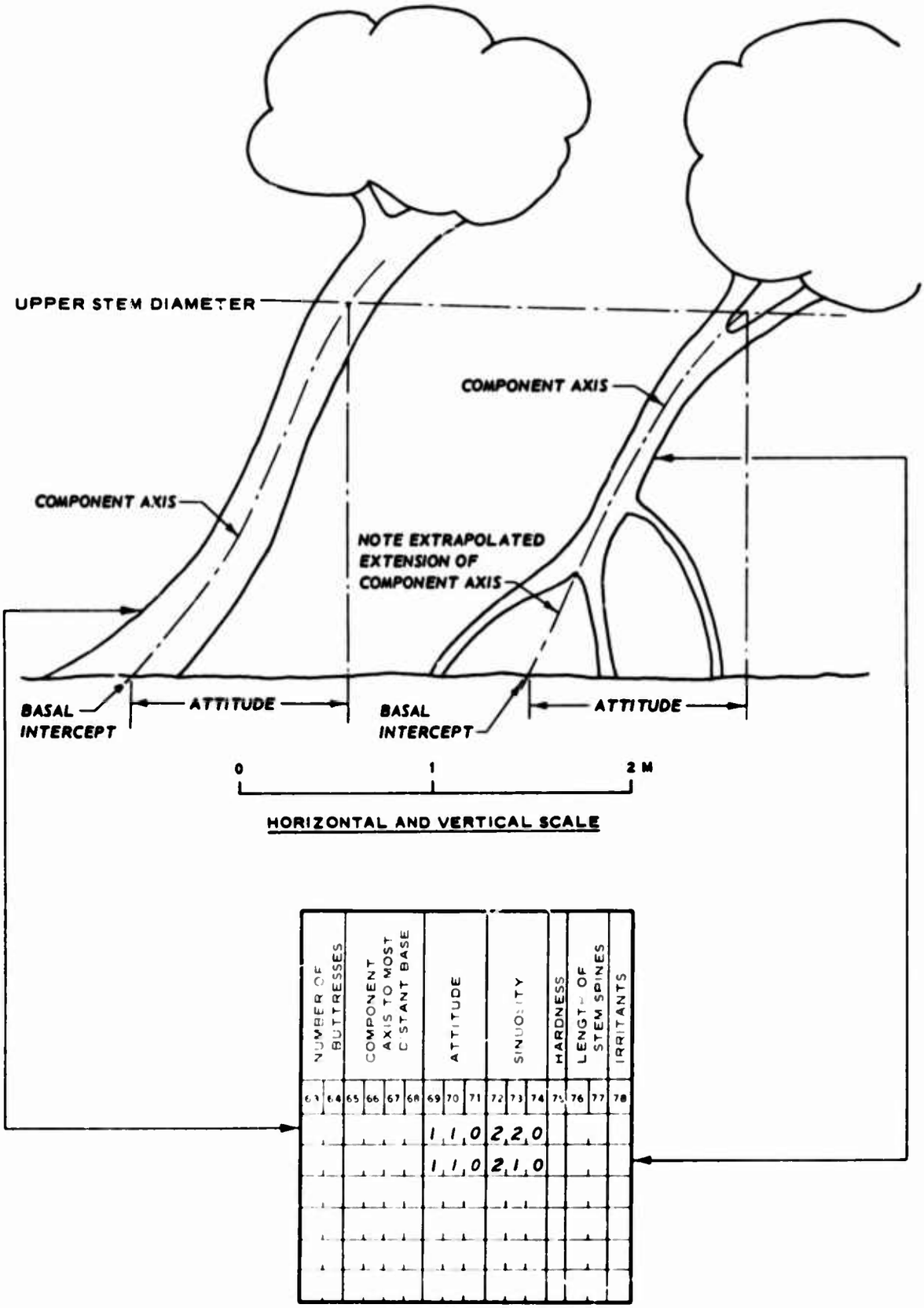


DISTANCE FROM BASAL INTERCEPT TO TIP OF BUTTRESS	BUTTRESS NO.
1.1	1
0.6	2
0.9	3
1.0	4
1.0	5
1.3	6
0.7	7
1.3	8
7.9	

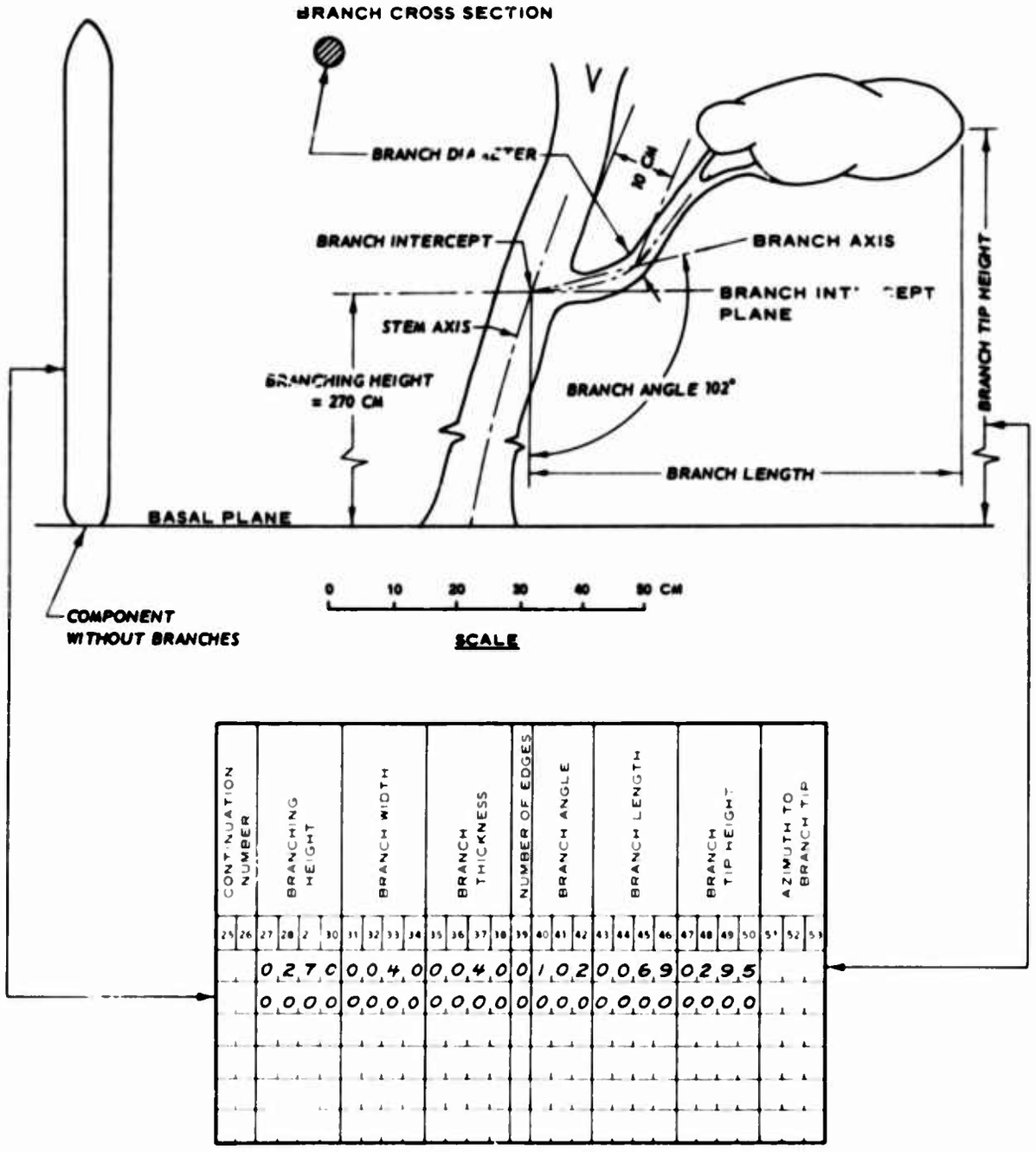
AVG = 1.0

ELEVATION OF BASE (45–48)	NUMBER OF BASES (49–50)	BASE DIAMETER (51–53)	MIDDLE STEM DIAMETER (54–56)	UPPER STEM DIAMETER (57–59)	HEIGHT OF FIRST STEM FURCATION (60–62)	NUMBER OF BUTTRESSES (63–64)	COMPONENT AXIS TO MOST DISTANT BASE (65–68)	ATTITUDE (69–71)
	01	200	065	025	180	08	0135	
	00	000	000	020	000	00	0000	

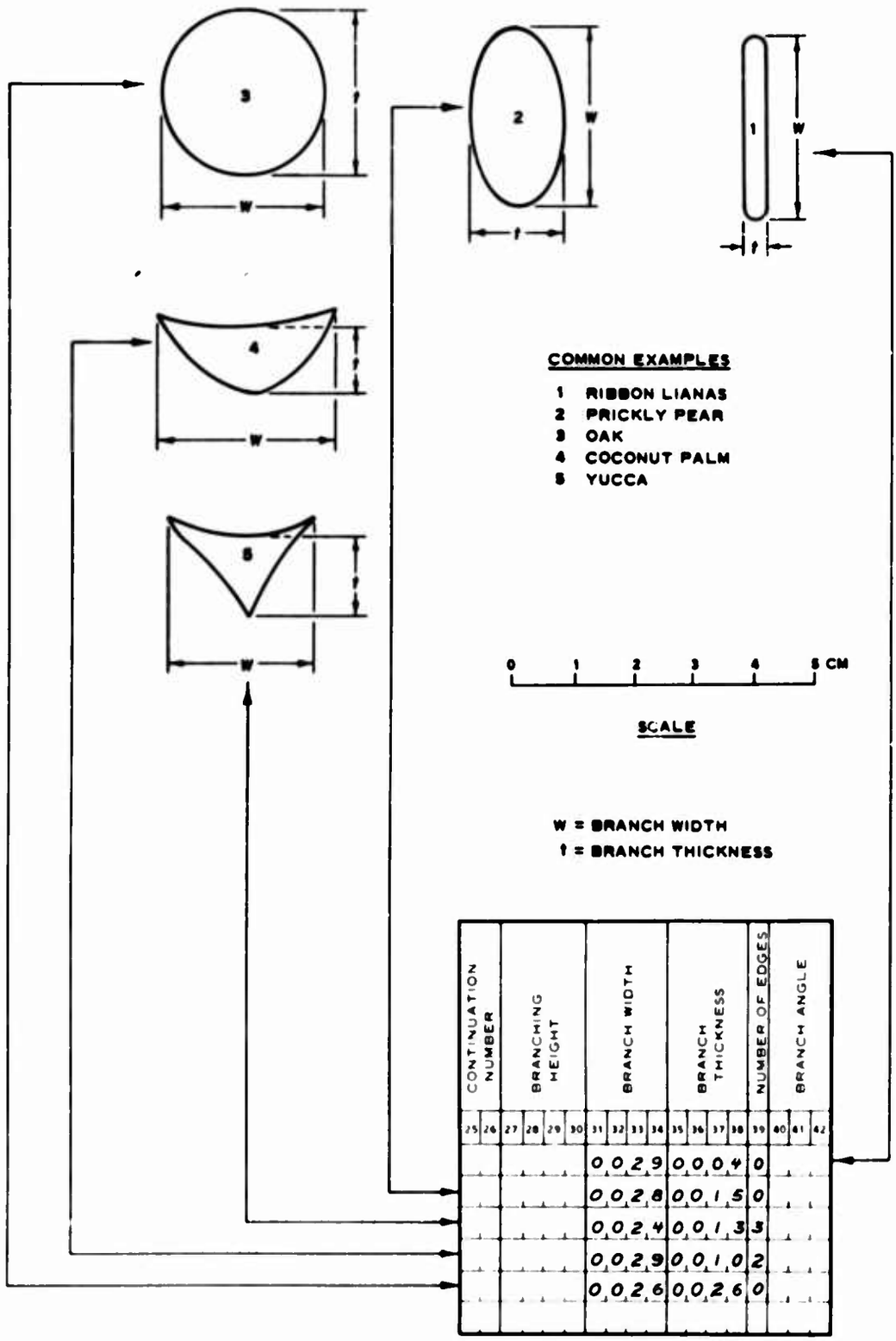
F:4-10. Notation of data concerning variations in structure of bases (buttress roots)



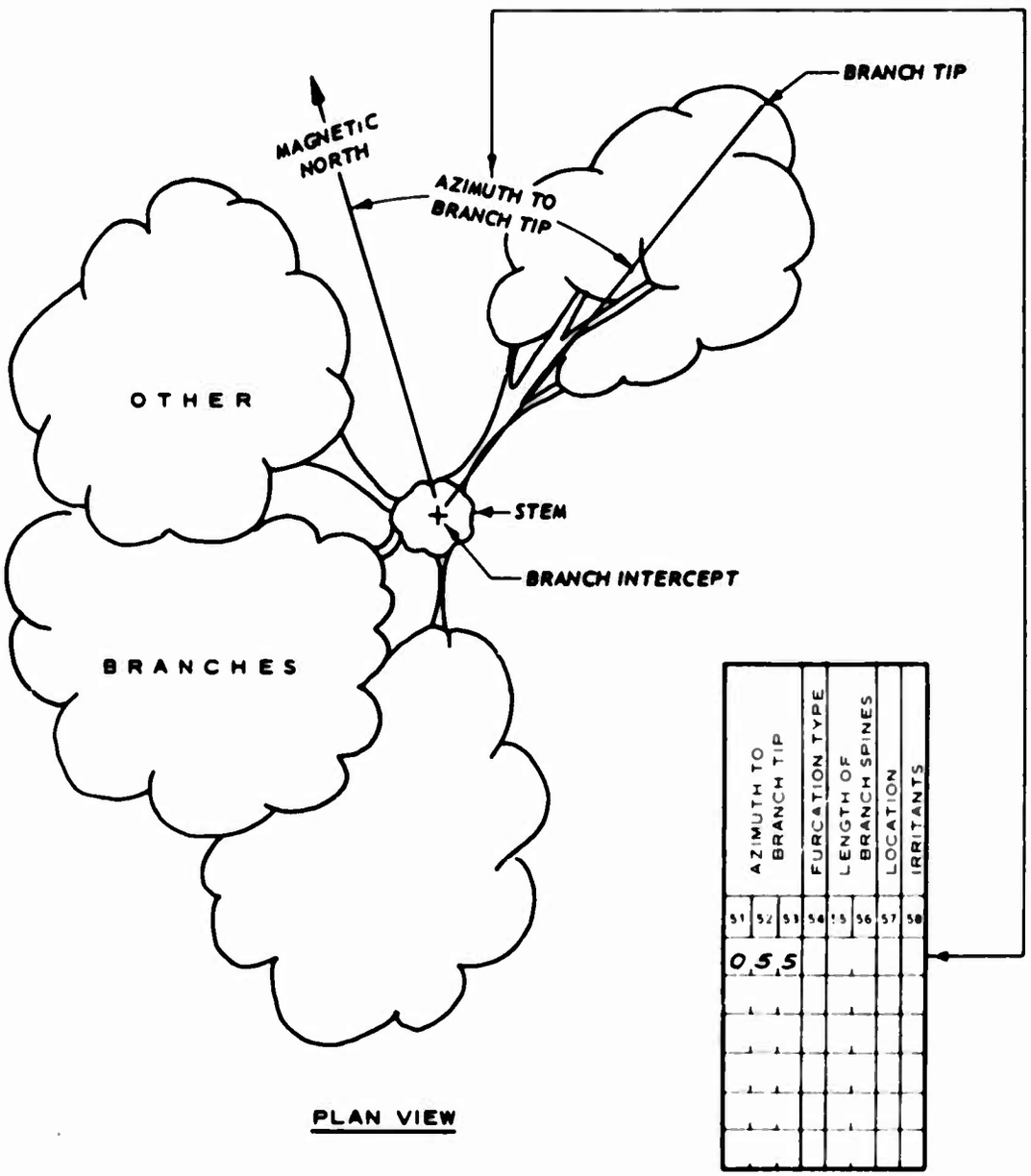
F:4-11. Recording of attitude and sinuosity



F:4-12. Recording of branching data

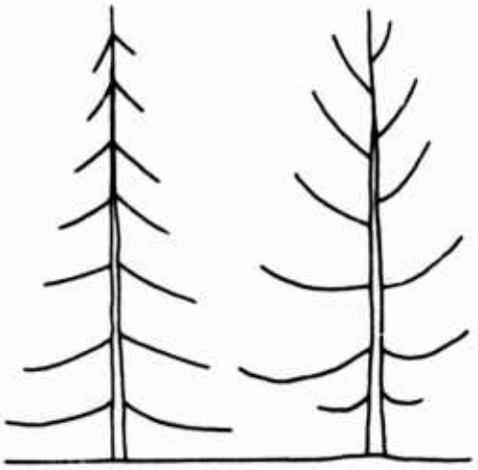


F:4-13. Notations concerned with branch cross-sectional shape and size

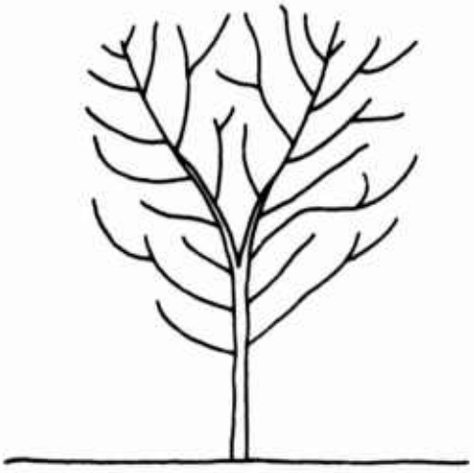


F:4-14. Determining and recording azimuth to branch tip

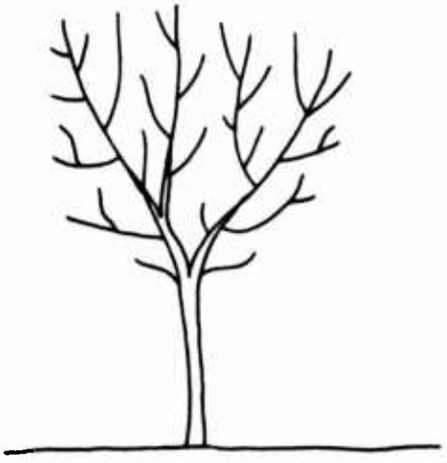
Code No.	Definition
1	Continuous central axis; stem goes vertically through the entire crown; highest tip of component is extension of stem.



2	Partial central axis; stem goes part way through crown, then furcates into two or more large branches; many, usually smaller, branches diverge from stem below point of major furcation.

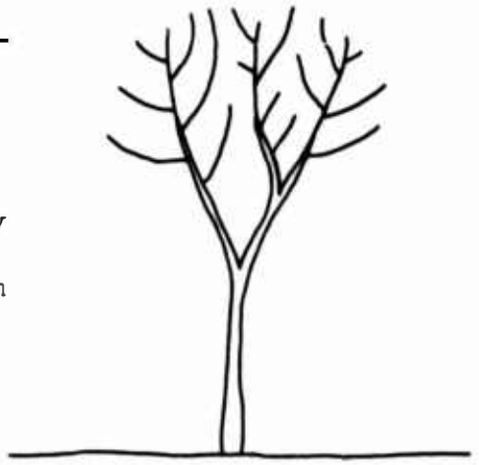


3	No central axis; stem furcates into two or more large branches at or near base of crown; first of many smaller branches originates at or near furcation of major branches.

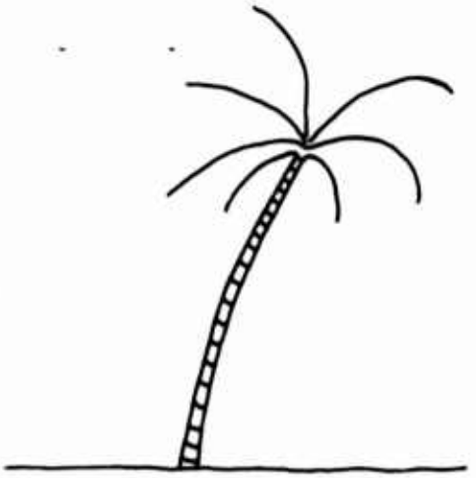


F:4-15. Definitions of furcation types (sheet 1 of 2)

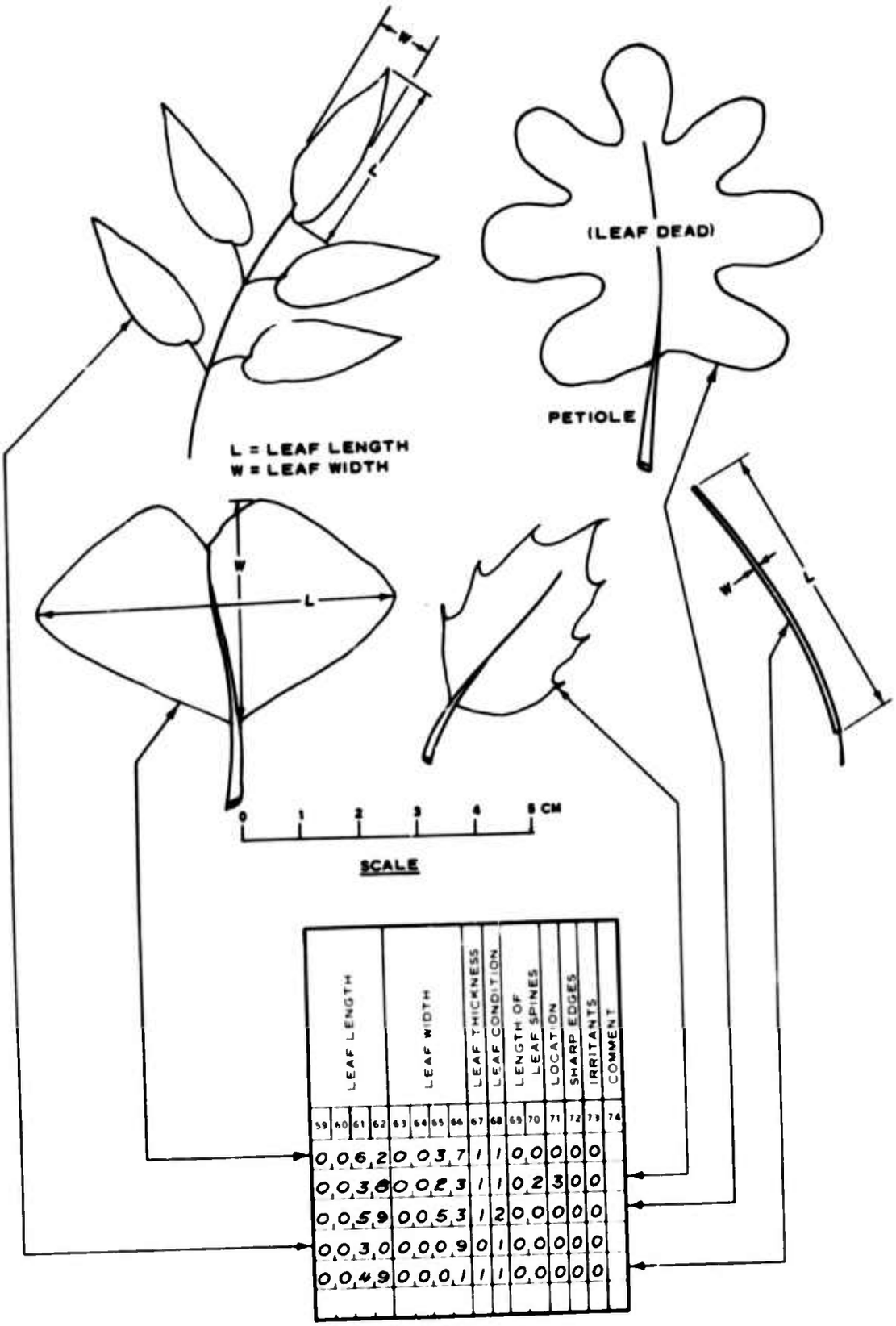
Code No.	Definition
4	Stem furcation; stem divides into two or more large branches well below leaf and twig mass; at most, only very small branches diverge from stem or major branches until well above point of initial furcation.



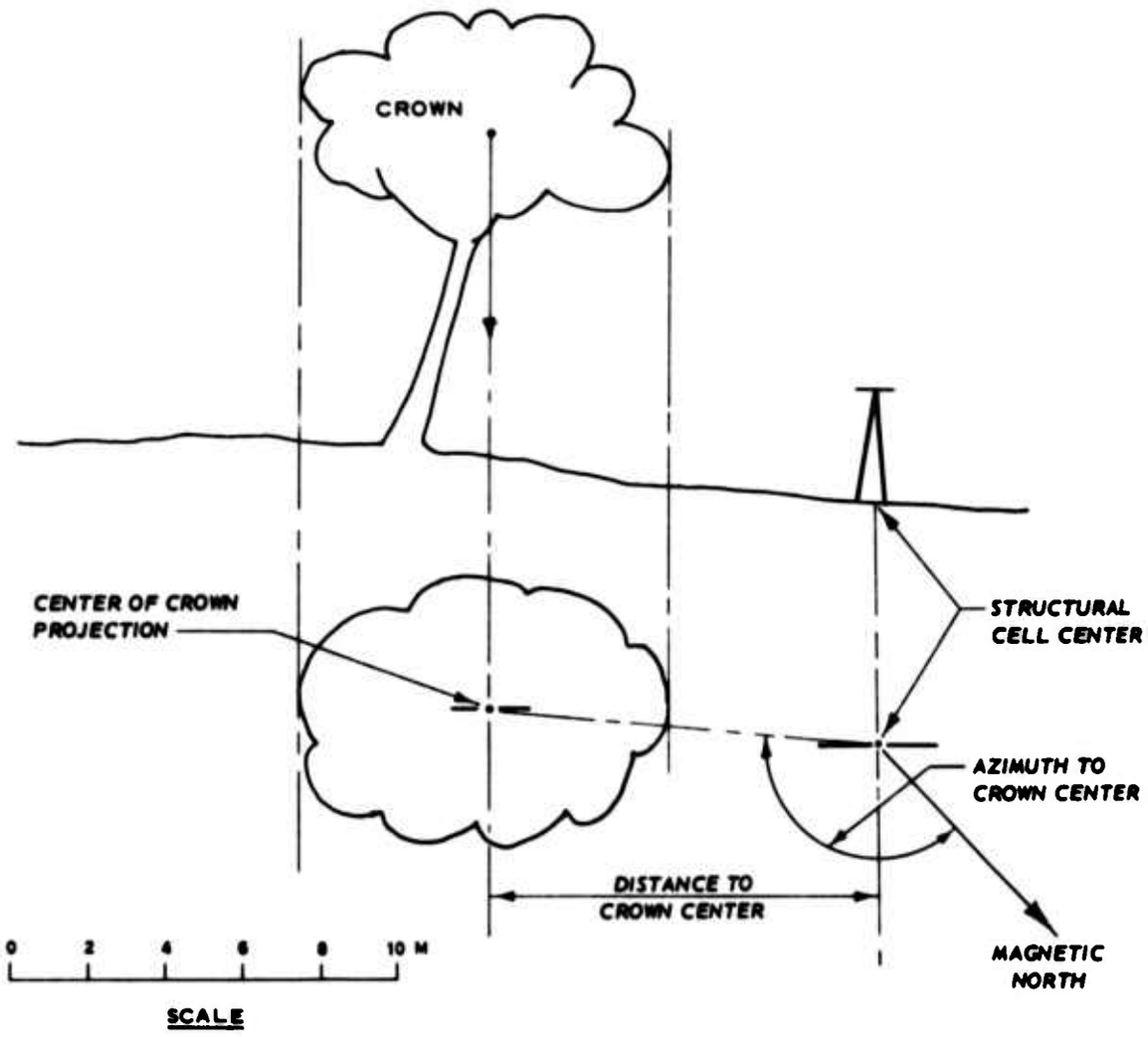
5	Radial; branches radiate from common or nearly common point; very few or no branches below point of major furcation; typified by various palms, tree-ferns, and creeping, decumbent, or prostrate weeds.

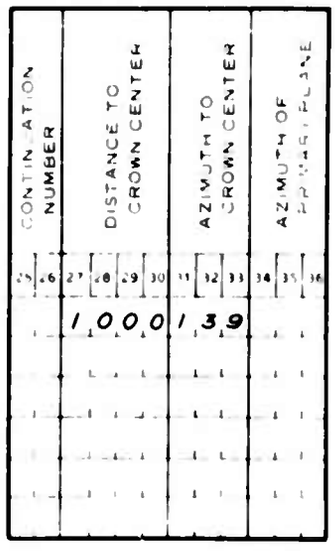


6	Entangled; branches emerge at odd angles and places, and tangle amongst themselves and other plants; typified by climbing and decumbent vines.

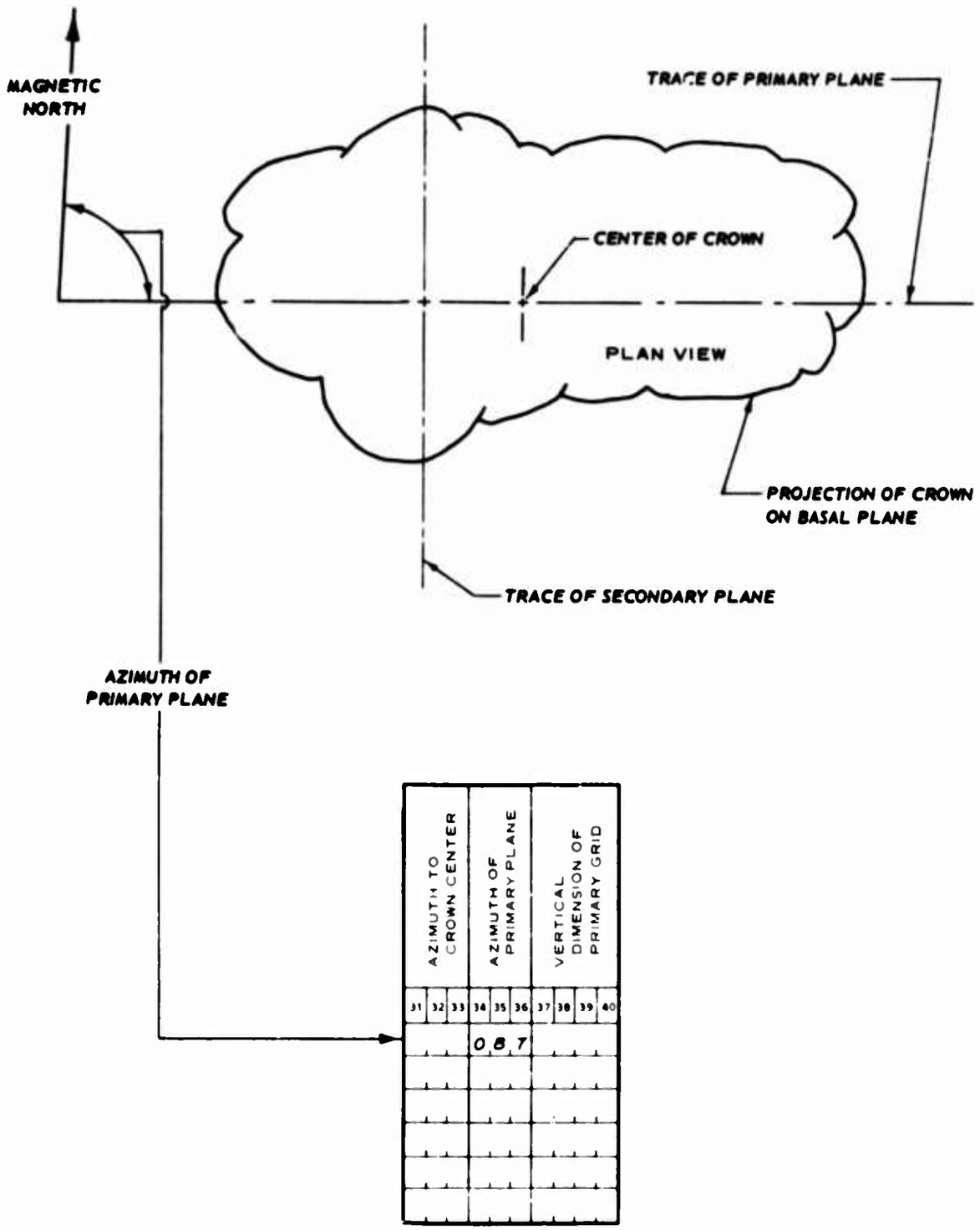


F:4-16. Notation of common leaf shapes

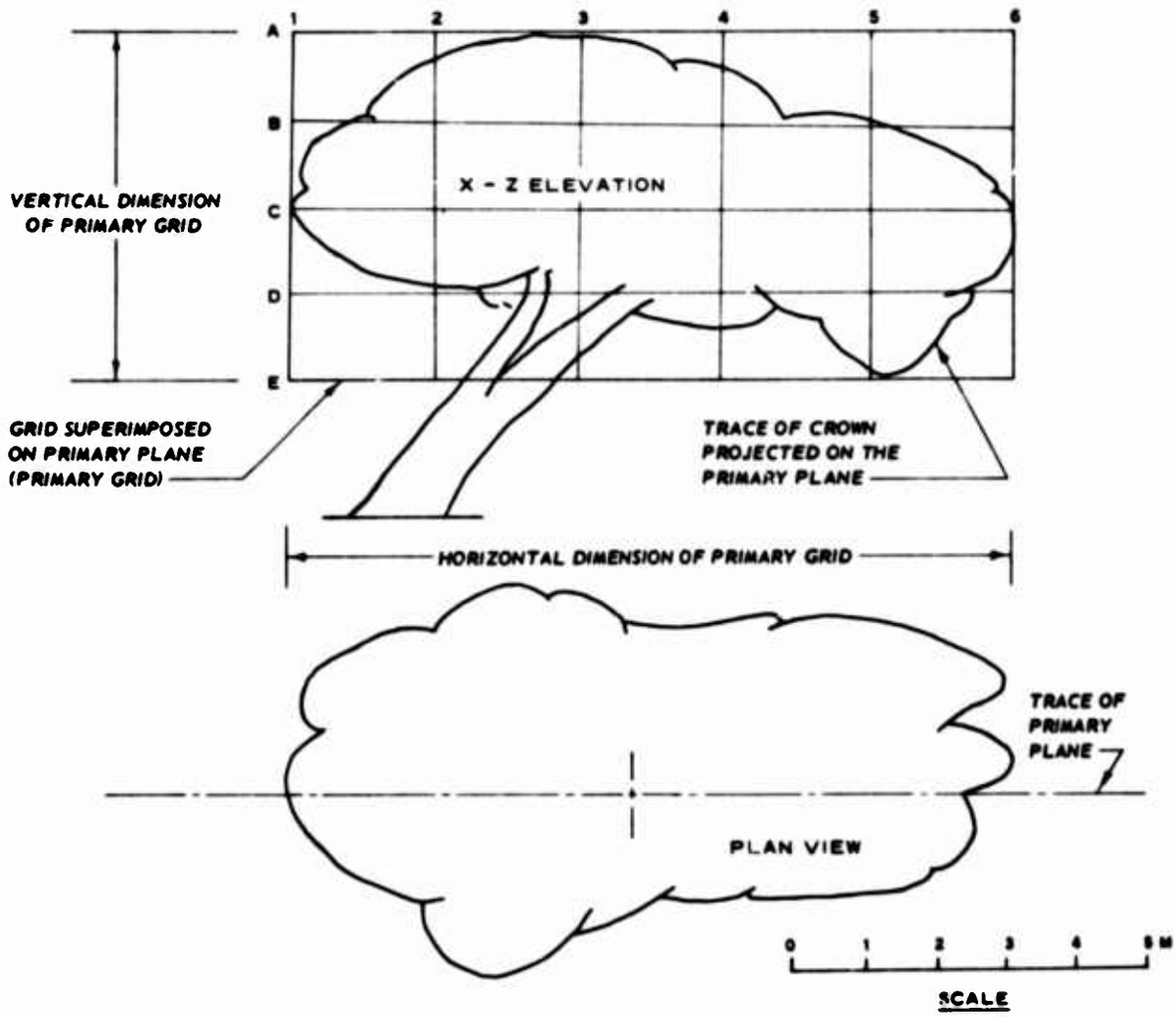


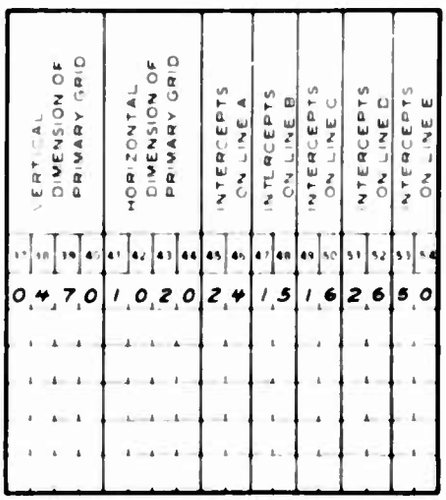


F:4-17. Recording the distance to crown center

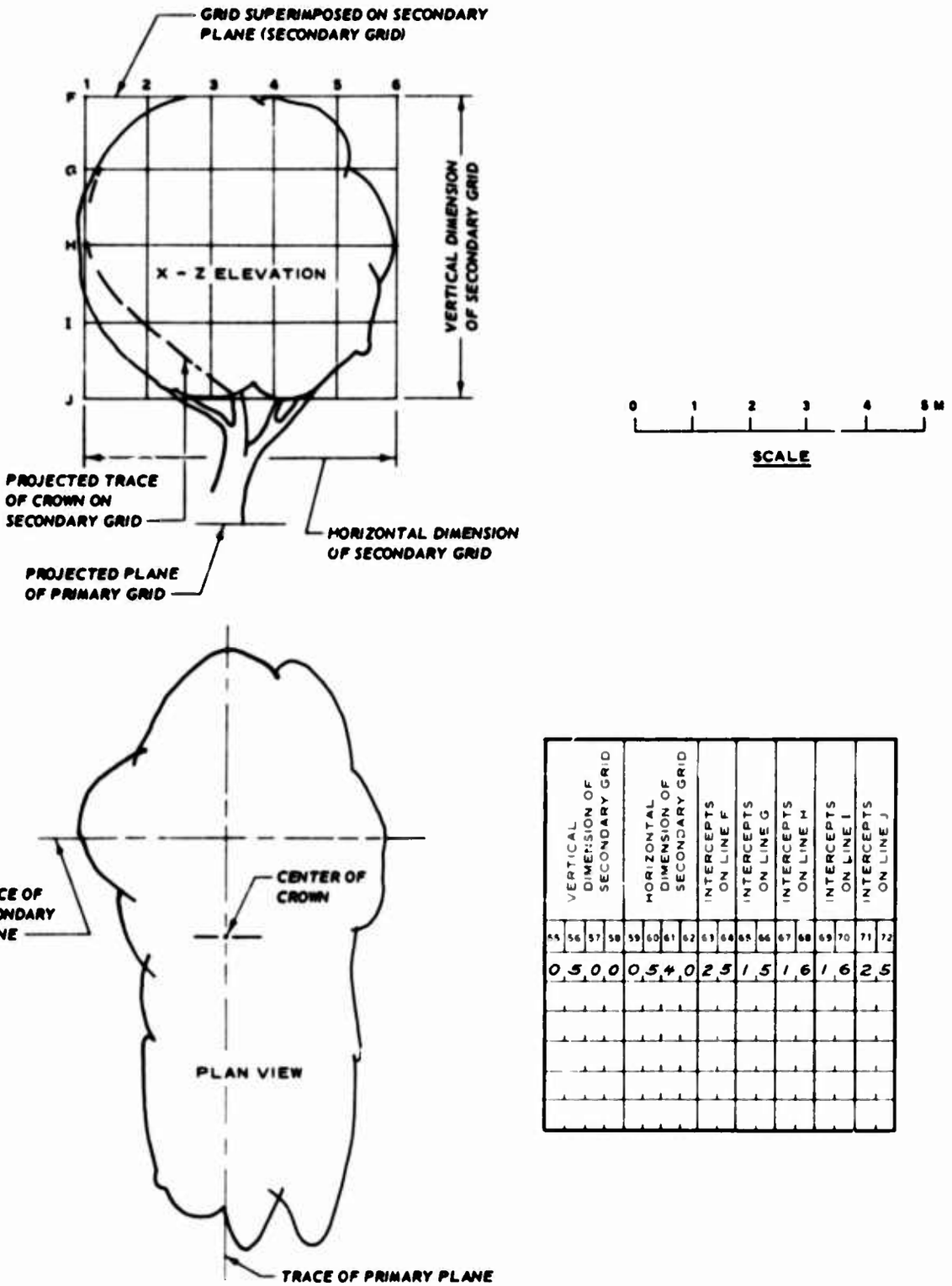


F:4-18. Recording of azimuth of primary plane





F:4-19. Recording of data from the primary grid



F:4-20. Recording of data from secondary grid

Instruction Module 5

PLANT NOMENCLATURE

A. These instructions are intended as guidelines for obtaining plant nomenclature information. Plant identification requires skill and training. Thus, in general, plant nomenclature data will be recorded only when a competent botanist or biologist is present. If it is not reasonably certain that a plant is being correctly identified, nomenclature information should not be recorded, since it is usually better to have no information rather than false information. Complete nomenclature data include three kinds of information: (a) the common or local name, (b) the botanical or "scientific" name, and (c) the reference that was used to confirm the plant identification.

Vegetation Nomenclature [F:5-1]
WES Form No. 1667, Rev. Jan 1968

B. Record the plant nomenclature data in the following sequence:

1. Country (1-3) {T:1-1} |code|: Record the code number of the country in which the site is located.
2. Site number (4-7) |count|: Record the number that has been assigned to this site.
3. Sample number (8-9) |count|: Record the number of times that the site has been sampled or described.
4. Factor family (10) |code|: The factor family reference number is preprinted on the data form.
5. Data form reference (11-12) |code|: The data form reference number is preprinted on the data form.
6. Data group reference (13-14) |code|: The data group reference number is preprinted on the data form.
7. Component number (15-17) |count|: Record the component number in this field.
8. Line number (18-20) |count|: On the first line used, place 001 in this field, and number successive lines sequentially.
9. Lines per component (21-22) |count|: In this field, record the total number of lines used to identify each component.

NOTE CONCERNING KINDS OF NAMES: Ideally the common name, the botanical (or "scientific") name, and the reference book or manual that has been used to validate the nomenclature should all be recorded. If all three kinds of information are available, follow the procedure described below.

10. Kind of information (23) |code|: On the first line devoted to any one component, record 1 in this field. This number specifies that information in this line consists of the common or local name of the component.

11. Repeat line (24-26) |count|: If this is the first time that this particular component name (either common or botanical) has been recorded for this site, place 000 in this field. However, if this particular component name has previously been recorded for this site (i.e., some component measured earlier also has this name), place the line number of the line on which the name was first used in this field. For example, if a "red oak" had previously been identified and the name has been recorded on line 007 (in columns 18-20), record 007 in this field. This indicates that the information in columns 27-76 (the "Component Name and Reference" field) in line 007 is to be repeated in this line.

NOTE CONCERNING COMMON NAME: Common or "local" names for plants often vary from locality to locality; a species known by one name in Illinois may have a completely different designation in Indiana. However, common names are useful and should be recorded when possible. The name that is recorded should be one used in a reference manual and/or at least be in common usage by local inhabitants. More than one common name may be given for a plant.

12. Component name and reference (27-76) [F:5-1] |narrative|: Write out, beginning in column 27, the common or local name of the component. Use capital (upper case) letters. It is most unlikely that more than one line will be needed. If all of the columns are not required, leave the spaces that are not used blank.

13. Total number of lines (77-79) |count|: Leave this field

blank until all nomenclature data for the entire site have been recorded. Then note the last number in the "Line Number" field (columns 18-20), and record that number in all lines in this field.

14. Comment (80) |code|: On the first line devoted to a site, place a 1 in this field. On the "Comments" data form (Instruction Module 6), record the last name of the person who made the plant identification. If there are other comments concerning the first line, write them out beginning on another line of the "Comments" data form.

NOTE: All data on common names have now been recorded, and one line of the data form has been used. For the recording of the botanical name, proceed as follows.

15. Country....Component number (1-17): Copy all numbers in the line above into this line.
16. Line number (18-20) |count|: Enter the next consecutive number following the one in this field in the line above. Example: If the number in the line above is 018, enter 019 in this field.
17. Lines per component (21-22) |count|: Leave this field blank until all nomenclature data for this component have been recorded. Then count the number of lines used for this component, and enter the number in this field. Example: If 6 lines were used for this component, enter 06 in this field.
18. Kind of information (23) |code|: Since the common name was recorded in the line above, the botanical or scientific name will be recorded in this line. Place a 2 in this field; this specifies that the information recorded in this line is the botanical name of the component.
19. Repeat line (24-26) |count|: If this is the first time this name has occurred in this sample, place 000 in this field. However, if the name has occurred in this sample previously, place the line number of the line on which the name was first used in this field (see item 11 for an example).

NOTE CONCERNING BOTANICAL NAME: A proper scientific or "Latin" name of a plant species consists of at least three parts. They are the genus, the specific epithet, and the author. The genus is the unit or section of the plant family to which an individual plant belongs. For example, oaks belong to genus QUERCUS, pines to genus PINUS, elms to genus ULMUS, etc. The specific epithet is the botanical adjective that identifies a group within a genus. The author(s) is the first person to publish a name designating a species; this person's name is always shown in authoritative manuals. Normally it is not known by even trained taxonomists as part of the memorized name for the plant, but with the genus and specific epithet it can be found in a good reference. To persons not trained in plant taxonomy, the full name of plants as shown in manuals may sometimes be confusing. They may show two authors with one in parentheses, and various abbreviations for authors' names, etc. All of this is governed by the International Code of Botanical Nomenclature and is too complicated and lengthy to go into here. However, the recorder is cautioned to use the full name of a plant as shown in the manual. Persons interested in the nomenclature for plants in a sampled assemblage will be able to decipher or to have deciphered the names as shown. If a question exists as to any part or parts of the proper botanical name place a question mark (?) before the doubtful item. For example, ULMUS ? RUBRA MUHL. indicates that the identifier knows the plant being designated is in the genus ULMUS but is not sure of the specific epithet. Many times the genus of a plant will be known with surety without any idea as to the specific epithet; in such a case, follow the genus name with the abbreviation "SP" (Ex: ULMUS SP). Examples of some properly designated botanical names with their common names are as follows:

QUERCUS ALBA L - white oak
COCOS NUCIFERA L - coconut palm
PINUS TORREYANA CARR - Torrey pine

20. Component name and reference (27-76) [F:5-1] |narrative|: Write out, beginning in column 27, the botanical name of the component in accordance with the information in the NOTE above. Use capital letters. It is unlikely that more than one line will be necessary.

21. Total number of lines (77-79) |count|: Leave this field blank until all nomenclature data for the entire site have been recorded. Then note the last number in the "Line Number" field (columns 18-20), and record that number in all lines in this field.

22. Comment (80) |code|: If this is the first line devoted to a site, see item 14 above for instructions. If it is not the first line, and there is a comment needed that is relevant to the information in this line, place a 1 in this field and write out the comment on the "Comments" data form in accordance with Instruction Module 6. If there are no comments, place a 0 in this field.

NOTE: All data on the botanical name have now been recorded. Assuming that a manual, flora, or reference book of some description has been used to confirm the component identification, proceed as follows.

23. Country....Component number (1-17): Copy all numbers in the line above into this line.

24. Line number (18-20) |count|: Enter the next consecutive number following the one in this field in the line above.

25. Lines per component (21-22) |count|: Leave this field blank until all nomenclature data for this component have been recorded. Then, count the number of lines used for this component, and enter the number in this field.

26. Kind of information (23) |code|: Since the botanical name was recorded in the line above, the reference source (manual, flora, etc.) used to confirm the identification of the component will be recorded in this line. Place a 3 in this field; this indicates that all data in this line refer to reference sources. If, as is usually the case, more than one line is needed, place a 3 in all lines used for reference source data.

27. Repeat line (27-29) |count|: If this is the first time this reference has been named as a source for plants in this sample, place 000 in this field. However, if the

reference has been cited before, place the line number on which the name was first used in this field.

NOTE CONCERNING REFERENCES: The person identifying the plant may consult a book ("Flora" or "Manual"), or he may be sufficiently well acquainted with the local flora to name the plant without consulting his reference. If a reference is consulted, cite that reference as follows:

a. Name of author(s) with surname preceding initials. (If more than three authors, give only the first author's name plus "et al.")

b. Book title

c. Edition number if necessary (e.g., "1st ed.")

d. Volume number if necessary, preceded by the work "Vol."

e. Name of publisher in shortened form (e.g., "Macmillan," not "The Macmillan Company")

f. Publisher's location (city only, or city, state, and country, if necessary)

g. Year of publication

If the information is made by sight recognition and without reference to a manual, record the word "field" as the reference, unless the identification and spelling of the name is later confirmed by reference to a manual.

28. Component name and reference (27-76) [F:5-1] |narrative|: Write out, beginning in column 27, the reference citation as described in the NOTE above. See F:5-1 for an example of such a citation. Use all capital letters. Leave blank all columns not needed. If the citation requires more than one line, as is usually the case, continue the citation in this field for as many lines as required. Be sure that all appropriate numbers are entered in columns 1-26 for all the lines that are used.

29. Total number of lines (77-79) |count|: Leave this field blank until all nomenclature data for the entire site have been recorded. Then note the last number in the "Line Number" field (columns 18-20), and record that number in all lines in this field.

30. Comment (80) |code|: If a comment is needed that is relevant

to the information recorded in this line, place a 1 in this field, and write out the comment on the "Comments" data form in accordance with Instruction Module 6. If no comments are needed, place a 0 in this field.

NOTE: In many cases, one or more of the kinds of information will be lacking. In such instances, record the data available, being sure that the "Kind of Information" field (column 23) is properly coded. Remember, the code is:

1 Common or local name

2 Botanical or "scientific" name

3 Identification reference

In addition, please note that if all three kinds of information are available, <u>at least</u> three lines will be required for recording the data. That is there will be <u>at least</u> one line for each kind of information.

COUNTRY	SITE NUMBER	SAMPLE NUMBER	FACTOR FAMILY	DATA FORM REFERENCE	DATA GROUP REFERENCE	COMPONENT NUMBER	LINE NUMBER	LINES PER COMPONENT	KIND OF INFO.	REPEAT LINE	CC
1 2 3	4 5 6 7	8 9	10	11 12	13 14	15 16 17	18 19 20	21 22	23	24 25 26	27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 4
141	0001	01	4	10	07	001	001	04	1	000	BLACK LOCUST
141	0001	01	4	10	07	001	002	04	2	000	ROBINA PSEUDO ACACI
141	0001	01	4	10	07	001	003	04	3	000	FERNARD M. L. GRAY'S
141	0001	01	4	10	07	001	004	04	3	000	ED. NEW YORK 1950
141	0001	01	4	10	07	002	005	04	1	001	
141	0001	01	4	10	07	002	006	04	2	002	
141	0001	01	4	10	07	002	007	04	3	003	
141	0001	01	4	10	07	002	008	04	3	004	
			4	10	07						
			4	10	07						
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			4	10	07						

WES FORM NO. 1667
REV JAN 1968

F:5-1. Vegetation nomenclatur

VEGETATION NOMENCLATURE

COMPONENT NAME AND REFERENCE	TOTAL NUMBER OF LINES	COMMENT
LOCUST		
2, PSEUDO ACACIA L.		
2, D. M. L. GRAY'S MANUAL OF BOTANY 8TH AMERICAN		
EW YORK 1950		

-1. Vegetation nomenclature data form

B

Instruction Module 6

COMMENTS

A. On many occasions in the sampling of vegetation structure and/or the other specified data, a situation will arise that cannot be clearly or completely represented by the data recorded on the prescribed forms. If this be the case, the matter can be more fully clarified by a word description concerning the point in question.

Vegetation Comments Data [F:6-1]

WES Form No. 1668, Rev. Jan 1968

B. For each "1" that has been placed in the comments field of any data form (starting with Instruction Module 1 and proceding through Instruction Module 5) record the following data.

1. Country (1-3) {T:1-1} |code|: Record the code number of the country in which the site is located.
2. Site number (4-7) |count|: Record the number that has been assigned to the site.
3. Sample number (8-9) |count|: Record the number of times the site has been sampled or described.
4. Factor family (10) {T:1} |code|: Select the code of the appropriate factor family and record it in this field. Since the site being examined is a vegetation site, the proper code number is 4.
5. Data form reference (11-12) |code|: The data form reference number is preprinted on the data form.
6. Data group reference (13-14) |code|: The data group reference is preprinted on the data form.
7. Comment number (15-16) |count|: Record 01 for the first comment, and number successive comments sequentially.
8. Line number (17-19) |count|: On the first line used place a 001 in this field, and number successive lines sequentially.
9. Lines per comment (20-21) |count|: Enter the number of lines used for each comment. If more than one line is used, be careful to repeat all the identification data

on the subsequent lines.

10. Referenced data group (22-23) |code|: Record the data group within which the comment originates.
11. Referenced line number (24-26) |count|: Enter the line number of the entry being commented on. If on the initial data form the entry covers several lines, enter only the first line appearing for that entry.
12. Referenced component number (27-29) |count|: If the comment concerns a specific component, record the number of the component. If it concerns other data, enter 000 in this field.
13. Referenced field number (30-31) |count|: Record the first column number of the field that contains the entry for which the comment is being made. If the comment consists of the name of the team leader, photographer, or botanist, enter 00 .
14. Comments (32-77) [F:6-1] |narrative|: Record the desired comments. Use only capital letters. The comments should be made as concise as possible but still cover the matter adequately. As many lines as necessary may be used for comments about any one item as long as the identification data are correctly repeated on each line. For example, F:6-1 illustrates how to record the name of the botanist who identified component 1 and 2 shown in F:5-1.
15. Total number of lines (78-80) |count|: After all the comments have been recorded, note the number in the last line in the "Line Number" field (columns 17-18) and record it in all lines in this field.

COMMENTS

COUNTRY	SITE NUMBER	SAMPLE NUMBER	FACTOR FAMILY	DATA FORM REFERENCE	DATA GROUP REFERENCE	COMMENT NUMBER	LINE NUMBER	LINES PER COMMENT	REFERENCED DATA GROUP	REFERENCED LINE NUMBER	REFERENCED COMPONENT NUMBER	REFERENCED FIELD NUMBER	
1 2 3	4 5 6 7	8 9	10	11 12	13 14	15 16	17 18 19	20 21	22 23	24 25 26	27 28 29	30 31	32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48
141	0001	01	4	10	08	01	001	01	07	001	000	00	FIFE K
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WES FORM NO. 1668
REV JAN 1968

F:6-1. Comments data form

A

COMMENTS

REFERENCED FIELD NUMBER	COMMENTS	TOTAL NUMBER OF LINES
30 31	32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77	78 79 80
0 0	F I F E K	

F:6-1. Comments data form

B

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13. ABSTRACT

Not applicable

DD FORM 1 NOV 68 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

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Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Environmental studies						
Plants						
Terrain analysis						
Vegetation						